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A Handbook of Key Federal Regulations and Criteria for Multimedia Environmental Control

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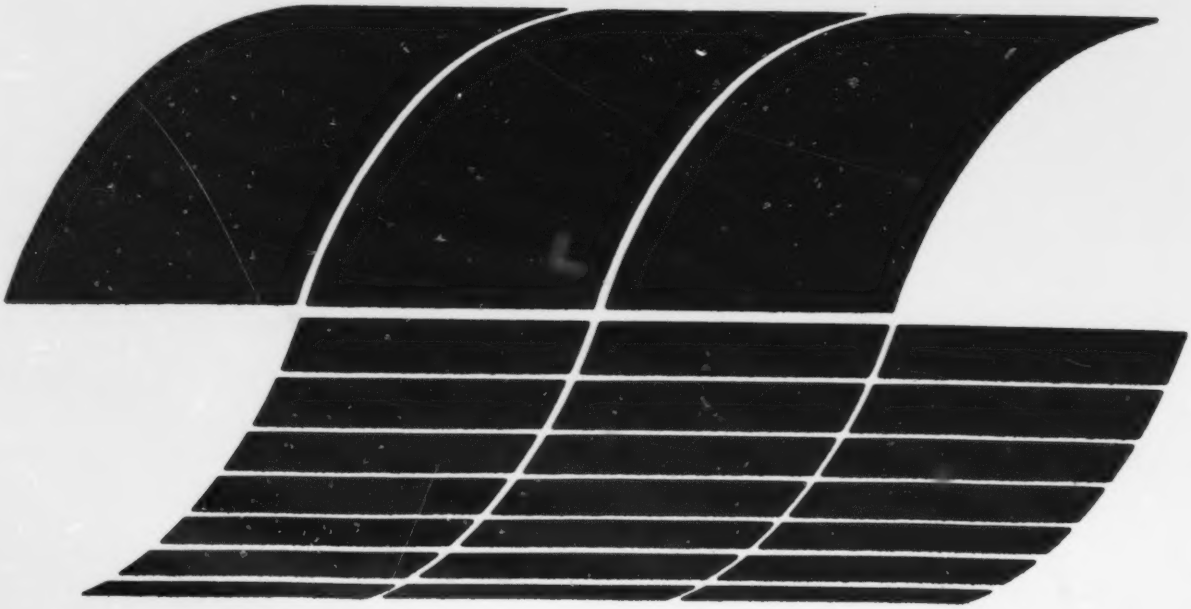

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The handbook summarizes major Federal environmental regulations and recommendations and the legislative acts that authorize them. It summarizes and tabulates quantitative control limits specified by Federal agencies. It compares the various regulations, standards, and criteria. It includes a selected bibliography addressing Federal environmental control activities.

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a. DESCRIPTORS	b. IDENTIFIERS/OPEN ENDED TERMS	c. COSATI Field/Group
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Regulations	Stationary Sources	05D
Legislation	Federal Regulations	
Standards	Quantitative Limits	14B
Criteria		
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Foreword

The intent of this report is to provide those working in the multimedia environmental control area an awareness of the types and breadth of regulations and criteria that have been and will be implemented. This compilation is not intended to be a definitive summary or an exhaustive listing. Nor, is the report able to reflect accurately the current status of regulations because of ongoing additions or changes.

The reader must constantly be aware that this compilation and related text will have the above limitations, and due to summarization may not always reflect the true intent of specific regulations.

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JK Burchard
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ABSTRACT

A summary of major Federal environmental regulations and recommendations and the legislative acts that authorize them is presented. Quantitative control limits specified by Federal agencies are summarized and tabulated. The various regulations, standards, and criteria are compared. A selected bibliography addressing Federal environmental control activities is included.

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LIST OF ABBREVIATIONS

Al_2O_3 - Aluminum oxide
As - Arsenic
bbls - Barrels
Btu - British thermal unit
C - Ceiling
°C - Temperature in degrees Celsius
cc - Cubic centimeter
Cd - Cadmium
CN - Cyanide
CO_2 - Carbon dioxide
Cr - Chromium
CrO_2 - Chromous
CrO_3 - Chromic
cu m - Cubic meter
2,4-D - 2,4-Dichlorophenoxy acetic acid
dBA - Decibels
DDD - 1,1-Dichloro-2,2-bis(p-chlorophenyl)ethane
DDE - 1,1-Dichloro-2,2-bis(p-chlorophenyl)ethylene
DDT - 1,1,1-Trichloro-2,2-bis(p-chlorophenol)ethylene
Do - Same as above
dscf - Dry standard cubic foot (air)
dscm - Dry standard cubic meter (air)
EDTA - Ethylenediaminetetraacetic acid
F - Fluorine
Fe - Iron
g - Gram
gal - Gallon
gr - Grain
ha - Hectacre
HCN - Hydrogen cyanide
Hg - Mercury
Hp - Horsepower

LIST OF ABBREVIATIONS (Continued)

hp-hr - Horsepower hour
hrs - Hours
H_2S - Hydrogen sulfide
kcal - Kilocalorie
kg - Kilogram
kkg - 10^3 kilograms
km - Kilometer
km^2 - Square kilometer
l - Liters
lb - Pound
LC_{50} - Concentration lethal to 50% of colony
m^2 - Square meter
m^3 - Cubic meter
mg - Milligram
min - Minute
ml - Milliliter
mm - Millimeter
Mn - Manganese
mpn - Most probable number
mrem - Millirem
MW - Megawatt
mW - Milliwatt
N - Nitrogen
ng - Nanogram
Ni - Nickel
NO - Nitrous oxide
NO_2 - Nitrogen dioxide
P - Phosphorus
Pb - Lead
PCB - Polychlorinated biphenyls
pct - Percent
pCi - Picocuries

LIST OF ABBREVIATIONS (Continued)

pH	-	Measure of acidity or alkalinity
ppb	-	Parts per billion
ppm	-	Parts per million
psia	-	Pound per square inch area
S	-	Secondary
sec	-	Second
SiO	-	Silicon oxide
SiO_2	-	Silicon dioxide
SO_2	-	Sulfur dioxide
Stat	-	Statute
T/2	-	Half-life
2,4,5-T	-	(2,4,5-Trichlorophenoxy)acetic acid
TCDD	-	2,3,7,8-Tetrachlorodibenzo-p-dioxin
TDE	-	Tetrachlorodiphenylethane
Te	-	Tellurium
TEPP	-	Tetraethylpyrosphate
2,4,5-TP	-	(2,4,5-Trichlorphenoxy)propionic acid
V_2O_5	-	Vanadium oxide
wt	-	Weight
Yr	-	Year
μci	-	Microcurie
μg	-	Microgram
μm	-	Micrometer

LIST OF ACRONYMS

ACGIH - American Conference of Governmental Industrial Hygienists

AEC - Atomic Energy Commission

ANSI - American National Standards Institute

AQCR - Air Quality Control Regions

BAT - Best Available Technology

BATEA - Best Available Technology Economically Achievable

BCT - Best Conventional Technology

BMP - Best Management Practice

BOD - Biological Oxygen Demand

BOD_5 - 5-Day Biological Oxygen Demand

BPT - Best Practicable Technology

BRH - Bureau of Radiological Health

CA - Court of Appeals

CAA - Clean Air Act

CEQ - Council on Environmental Quality

CFR - Code of Federal Regulations

COD - Chemical Oxygen Demand

CWA - Clean Water Act

DOD - Department of Defense

DOE - Department of Energy

EGD - Effluent Guidelines Division

EIS - Environmental Impact Statement

EPA - Environmental Protection Agency

FIFRA - Federal Insecticide, Fungicide, and Rodenticide Act

FR - Federal Register

FRC - Federal Radiation Commission

FWPCA - Federal Water Pollution Control Act

GAC - Granulated Activated Charcoal

GC/MS - Gas Chromatography/Mass Spectrophotometry

HEW - Health, Education, and Welfare

ICC - Interstate Commerce Commission

ICRP - International Commission on Radiation Protection

LIST OF ACRONYMS (Continued)

LAER - Lowest Achievable Emission Rate
NA - Nonattainment
NAAQS - National Ambient Air Quality Standards
NAS - National Academy of Science
NBS - National Bureau of Standards
NCI - National Cancer Institute
NCRP - National Council on Radiation Protection
NCRPM - National Council on Radiation Protection and Measurement
NEPA - National Environmental Policy Act
NESHAP - National Emission Standards for Hazardous Air Pollutants
NIEHS - National Institute for Environmental Health Sciences
NIOSH - National Institute for Occupational Safety and Health
NPDES - National Pollutant Discharges Elimination System
NRC - Nuclear Regulatory Commission
NRDC - Natural Resources Defense Council
NSF - National Science Foundation
NSPS - New Source Performance Standards
OAQPS - Office of Air Quality Planning and Standards
ORD - Office of Research and Development - EPA
OSHA - Occupational Safety and Health Administration
PL - Public Law
POM - Polycyclic Organic Matter
POTW - Publicly Owned Treatment Works
PPAH - Particulate Polynuclear Aromatic Hydrocarbons
PSD - Prevention of Significant Deterioration
RCRA - Resource Conservation and Recovery Act
SDWA - Safe Drinking Water Act
SIP - State Implementation Plans
TDS - Total Dissolved Solids
TKN - Total Kjeldahl Nitrogen
TLV^{R} - Threshold Limit Values

LIST OF ACRONYMS (Continued)

TSCA	-	Toxic Substances Control Act
TSL	-	Toxic Substances List
TSS	-	Total Suspended Solids
TTHM	-	Total Trihalomethanes
Tu	-	Turbidity units
TWA	-	Time Weighted Averages
USC	-	United States Code

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1.0 INTRODUCTION

This review of Federal environmental regulations is timely in view of recent challenges within both the public domain and the Federal Government, to current U.S. regulatory policy. In recent years, there has been increasing public pressure to protect the environment by a rapid proliferation of regulations. Indeed, the speed with which these regulations have been adopted or changed has created some concern and confusion among those affected by them. Nevertheless, a strong commitment remains to the environmental protection mandate and the current approach to legal controls.

The text makes little or no attempt to evaluate or describe the political, economic, social or legal and scientific technicalities involved in regulation formulation and enforcement. For such details, the reader is referred to citations listed in the text, to the Federal Register, Code of Federal Regulations (cf. Appendix A), or to the bibliography of Appendix B.

This handbook concentrates on information about specific pollutants, concentrations, industrial control levels, and defining the areas to which each regulation applies. The information should be relatable to process or control system design and provide an overview of what substances, within the scope of knowledge to date, have been officially (i.e., federally) designated hazardous or environmentally significant. The information herein covers all areas of the environment which can be polluted (air, water, land) and are therefore controlled--hence the term multimedia.

Federal regulations are the primary product of the environmental assessment process, and, as legally enforceable limitations, constitute the "last word" on specific pollutants. Thus, regulations must be of interest to all who are involved with environmental protection.

Obviously, this data base does not give all the information required for making an environmental assessment or selecting control technology. Variances and other exceptions to the regulations are common, patterns of enforcement are not well established in some areas, regulations are constantly being challenged in court, and revisions to the regulations are always being made. Also, little attention is given here to the increased influence of Federal control in projects involving government funds. Any of these factors may be most important in planning and control.

One of the most obvious patterns in the development of environmental protection procedures has been increased responsibility of the Federal Government, primarily through the Environmental Protection Agency. This approach has allowed more uniform regulation and control, solutions to interstate problems, and the assurance of a national commitment to solving environmental problems.

An example of the progress of environmental protection can be seen in U.S. water pollution control:

In 1948, the *Federal Water Pollution Control Act (FWPCA)* was passed. It provided limited Federal authority to be administered by the Department of the Interior, while primary control and enforcement authority remained with the States. The Federal responsibility for FWPCA enforcement was transferred to the Department of Health, Education, and Welfare in 1956, and in 1966, it was transferred again to the Department of the Interior. Individual states still retained initiative and authority in the area of water pollution control.

It was not until the creation of the Environmental Protection Agency in 1970, and the transfer of the authority for protection of the United States water quality to that organization, that the Federal government began to provide specific programs for water pollution control. The FWPCA stated as its goal the restoration and maintenance of the chemical, physical, and biological integrity of the waters, and EPA was given the responsibility to develop programs to make the United States' waterways fishable and swimmable by 1983 and to achieve zero discharge of pollutants by 1985. The FWPCA has been amended yearly to provide additional authority for these programs.

Public influence in environmental issues has continued to have a major effect in setting goals for EPA's water pollution control program. In response to four citizen suits, a Settlement Agreement was reached in 1976, resulting in a Consent Decree Document listing 65 specific pollutants whose discharges were to be regulated by effluent limitations and pretreatment standards. The National Pollution Discharge Elimination System (NPDES) has been used to monitor compliance with the various effluent limitations set.

The *Clean Air Act* was enacted in 1963. This legislation resulted from increasing publicity concerning the adverse health effects of air pollution. The Department of Health, Education, and Welfare was given the job of providing Federal leadership in the area of air pollution control. As in the case of water pollution, the majority of the authority remained with the States. In 1967, the Air Quality Act was passed. This provided Federal criteria for air quality with State enforcement.

When EPA was established in 1970, it was given the HEW authority in the area of air pollution. That year, the Congress passed the Clean Air Act Amendments, which provided the authority for EPA to establish National Ambient Air Quality Standards (NAAQS), National Emission Standards for Hazardous Air Pollutants (NESHAPs), and New Source Performance Standards (NSPS) for stationary sources. More recently, the Clean Air Act Amendments of 1977 provide a mechanism for instituting a program for Prevention of Significant Deterioration (PSD) and Non-Attainment (NA) regulations. These regulations provide for continued protection of the existing background ambient air quality.

The *Safe Drinking Water Act (SDWA)* amends the Public Health Service Act and is established primarily to assure that the public is provided with safe drinking water. It provides the legislative initiative under which the Primary and Secondary Drinking Water Regulations are promulgated by EPA. These regulations apply to all public drinking water systems. This act also provides for the protection of underground sources of drinking water, assures that there will be adequate supplies of chemicals needed to treat public water systems, and establishes the

National Drinking Water Advisory Council to make recommendations to the Environmental Protection Agency about matters relating to this act.

The *Occupational Safety and Health Act of 1970* authorizes the development and enforcement of standards for safe and healthful work conditions and for protection against workplace toxic substances. It provides assistance to the States to develop workplace safety and health programs and provides funding for research and education in the field of occupational safety and health. The Occupational Safety and Health Administration (OSHA) was created to administer these programs. The act also created the National Institute for Occupational Safety and Health (NIOSH). NIOSH has the responsibility of conducting research and making recommendations for the OSHA regulatory standards.

The *Atomic Energy Act of 1954* established the basis for the regulation of ionizing radiation. It created the Atomic Energy Commission (AEC), which is now defunct, the Federal Radiation Council (FRC), and the Bureau of Radiological Health (BRH). With the creation of the Environmental Protection Agency in 1970, the FRC was dissolved, and its functions were assigned to the EPA. When the AEC was dissolved in 1975, its regulatory functions were assigned to the Nuclear Regulatory Commission (NRC).

The *Toxic Substances Control Act (TSCA)* was established to regulate chemicals not controlled by established mechanisms. Under this act, a number of existing chemicals would be selected each year for testing and possible regulation. The act required that each new chemical product be subjected to a testing regimen prior to marketing.

It is the objective of the *Federal Environmental Pesticide Control Act of 1972*, or as it is commonly known, the *Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA)*, to assure the safety of pesticide chemicals. In order to accomplish this goal, a permit program has been established by EPA to control the manufacture, distribution, and application of pesticides. Also under this act, regulations are promulgated specifying tolerance levels for certain pesticide chemicals in or on specific agricultural commodities.

The *Noise Control Act of 1972* was legislated to control the emission of noise detrimental to the human environment. Under this act, specific regulations on noise are promulgated by EPA. The act specifies that noise limitations should be set for major noise sources in the following categories:

1. Construction equipment.
2. Transportation equipment (airplanes, railroads, and trucks).
3. Any motor or engine.
4. Electrical or electronic equipment.

It provides for the proper labeling of (1) the noise level produced by products capable of emitting noises that might "adversely affect the public health or welfare," and (2) the effectiveness of products for the purpose of reducing noise.

The *Resource Conservation and Recovery Act of 1976 (RCRA)* provides technical and financial assistance for the development of management plans and facilities for the recovery of energy and other resources from solid waste and for the safe disposal of discarded materials, and to regulate the management of hazardous waste. Solid waste management information and guidelines stipulate that EPA must describe levels of performance for disposal facilities in order to protect (1) the quality of ground and surface waters from leachates, (2) the quality of surface waters from runoff, (3) ambient air quality, (4) public health from disease and pest control, and (5) safety and aesthetics. The guidelines also stipulate minimum State criteria for solid waste management.

The *Marine Protection, Research, and Santuaries Act of 1972* addresses unregulated dumping operations in ocean waters. To accomplish this, the act provides for an Environmental Protection Agency permit program for all ocean-dumping activities in territorial marine waters. The act also mandates a comprehensive and continuing research program into the effects of pollution, overfishing, and other man-induced ecological effects on the marine environment. In addition, the Secretary of Commerce is given the authority to designate areas of the ocean as marine sanctuaries.

The *National Environmental Policy Act of 1969 (NEPA)* established a national environmental policy and deals with the implementation of the policy goals. The act provides for the consideration of environmental consequences of Federal actions by requiring Environmental Impact statements on all Federal projects affecting the environment. The Council on Environmental Quality was also created under this act.

The *Rivers and Harbors Act* provides a permit system to regulate dredge and fill activities in navigable waters.

The *Oil Pollution Act of 1961* deals with discharge of oil or oily mixtures from any ship at sea, maintenance of complete records of all oil transfers, and penalties for the spillage of any oil.

The *Coastal Zone Management Act* calls for a comprehensive, long-range, and coordinated national program for the management, beneficial use, protection, and development of the land and water resources of the nation's coastal zones. To facilitate the achievement of these goals, the act established a National Council on Marine Resources and Engineering Development, and a Commission of Marine Science, Engineering, and Resources. It also provided for funding from the States to acquire property for the establishment of estuarine sanctuaries and to provide public access to beaches.

The following text describes the specific results of the major environmental legislation. The summary compares the various types of limitations. The body of the report describes the specific regulations resulting from each legislative act. The Appendices contain an index to the Public Laws and Code of Federal Regulations cited in this handbook, a listing of criteria documents published by the National Institute of Occupational Safety and Health and American National Standards Institute and a unit conversion chart. It is hoped that constant updating of the information will allow this to serve as a useful tool.

2.0 SUMMARY

This section summarizes in tabular form some of the most pertinent information concerning Federal environmental standards. In some of the tables, regulations are cross-referenced and correlated with respect to legislative act, time, media, control levels, and pollutants.

There are 18 categories of adopted or proposed Federal regulations that establish quantitative, enforceable, environmental control limits. These categories of regulations are listed in Table 1 with the corresponding authorizing legislation. These regulations address noise, pesticides, radionuclides, and toxic substances as well as a variety of other contaminants in air, water, and land.

Table 2 presents a listing of regulations that set milestones in environmental control. In Table 3, the regulations are organized according to the media to which they apply. Most of the standards address air and water pollution.

The responsibility for the promulgation and enforcement of these regulations rests with the EPA, the OSHA, and the NRC. The specific offices within these agencies which are associated with the various regulations are listed in Table 4. It may be noted that offices within EPA have authority for most of these regulations. For that reason, a more detailed organizational chart of EPA is included as Table 5. Although the above agencies are responsible for the actual promulgation and enforcement of standards, they receive official recommendations from a variety of sources. These sources are listed in Table 6.

Table 7 is a flow chart for the process of promulgating an environmental regulation.

Regulations that have been promulgated with enforceable quantitative control limits are tabulated in Table 8. The pollutants controlled by these limits are found in Table 9. Point source discharges that are addressed as specific industrial sources are listed in Table 10. In Table 11, regulations are presented in decreasing order of severity (based on control limitations) for those pollutants addressed by more than one set of regulations. Table 2 summarizes projected new regulations.

A discussion of each specific category of regulations may be found in Sections 3 through 13 of this report.

TABLE 1. CATEGORIES OF ENVIRONMENTAL REGULATIONS AND ACTIVITIES LISTED BY LEGISLATIVE ACTS

Legislative Acts Authorizing Environmental Control Activities	Environmental Activities or Categories of Regulations Established
Clean Air Act	National Ambient Air Quality Standards Mobile Source Emission Standards National Emissions Standards for Hazardous Air Pollutants New Stationary Source Performance Standards
Federal Water Pollution Control (Clean Water Act)	Quality Criteria for Water National Pollutant Discharge Elimination System EPA Point Source Effluent Standards Toxic Pollutant Effluent Standards Pretreatment Standards Oil and Hazardous Substance Regulations Consent Decree (Settlement Agreement)
Safe Drinking Water Act	National Interim Primary Drinking Water Regulations National Secondary Drinking Water Regulations
Occupational Safety & Health Act of 1970	Limitations for Toxic and Hazardous Substances in Workplace Air
Atomic Energy Act	Effluent Limitations for Radionuclides Nuclear Fuel Cycle Regulations Limits for Burial of Radionuclide
Toxic Substances Control Act	Establishment of Interagency Testing Committee Compounds Recommended for Testing Regulations on PCBs and Fully Halogenated Chlorofluoroalkanes
Federal Insecticide, Fungicide, and Rodenticide Act	Registration Rules Classification and Use Restrictions Pesticide Tolerance Levels on Agricultural Commodities
Noise Control Act of 1972	Noise Regulations Low Noise Emission Product Standards
Resource Conservation and Recovery Act of 1976	Proposed Hazardous Waste Regulations Solid Waste Regulations
Marine Protection, Research, and Sanctuaries Act	Permit System for Ocean Dumping

TABLE 2. MILESTONE REGULATIONS IN ENVIRONMENTAL CONTROL AND POLLUTANTS OR INDUSTRIES AFFECTED

Legislative Act	Regulatory Activity	Date
Clean Air Act 1965 Air Quality Act 1967 --Amended 1970	Final NAAQS	4/30/71
	Final SIP Requirements	8/14/71
	Final Group I NSPS	12/23/71
	Final NESHAP Regulations for Asbestos, Beryllium, and Mercury	4/6/73
	Final Group II NSPS	3/8/74
	Mobile Source Standards	9/19/75
Clean Air Act Amendments of 1977	Proposed Addition of Lead to NAAQS	12/14/77
	Proposed Change of Oxidants to Ozone in NAAQS	6/22/78
	Proposed Mobile Source Standards for 1981--Light Duty Vehicles	8/78
	NSPS Proposed Priority List Published	8/31/78
Federal Water Pollution Control Act 1948 -- Amended 12/28/73 1/2/74 1/2/75 3/23/76 12/27/77	Proposed Toxic Pollutant Standards	12/27/73
	First Source Based (wet corn milling) effluent standard	4/75
	Water Quality Criteria	9/76
	Final Toxic Pollutant Standards	1/12/77
	Final Harmful Quantities of Hazardous Substances Lists and Penalties	3/13/78
	Proposed Pretreatment Program	7/78
Safe Drinking Water Act 1974	Primary Drinking Water Standards	12/24/75
	Secondary Standards	3/31/77
	Organics	7/6/78
Occupational Safety and Health Act of 1970	Adoption of Asbestos Workplace Air Contaminant Level	7/7/72
	Adoption of Permissible Exposure Limits for Over 400 Chemicals	5/29/71
	Proposed Carcinogen Policy	10/77
Atomic Energy Act 1954	Radionuclides in Effluents	10/60
Reorganization Act 1970	Nuclear Fuel Cycle Regulations	12/28/76
Toxic Substances Control Act	Regulations of Fluorocarbons	2/78
	Regulations of PCBs	4/78
Federal Pesticide Control Act	Registration Guidelines	8/25/71
	Revised Guidelines	9/8/75 7/10/78

continued

TABLE 2. (continued)

Legislative Act	Regulatory Activity	Date
Noise Control Act	Low Noise Emission Standard	2/21/74
	Railroad Noise Emission Standard	1/14/76
Resource Conservation and Recovery Act	Solid Waste	8/14/74
	Hazardous Waste	4/28/78 7/11/78
NEPA	Guidelines	1974
	New Guidelines Proposed	6/9/78

TABLE 3. FEDERAL REGULATIONS SPECIFIED BY MEDIA

AIR

National Primary and Secondary Ambient Air Standards
Mobile Source Emission Standards
National Emission Standards for Hazardous Air Pollutants
New Stationary Source Performance Standards
Occupational Safety and Health Administration Standards
Air Contaminants Resulting from Hazardous Waste Treatment, Storage, and Disposal Emissions

WATER

Toxic Pollutants Effluent Standards
EPA Point Source Effluent Standards
Pretreatment Standards
Harmful Quantities of Hazardous Substances
Interim Primary and Secondary Drinking Water Standards
Standards for Protection Against Radiation
(Effluent Limits for Radionuclides)

SOIL

Standards for Protection Against Radiation
(Limits for Burial of Radionuclides)
Hazardous Waste Regulations

TABLE 4. AGENCY OFFICES RESPONSIBLE FOR FEDERAL REGULATIONS AND STANDARDS

Category of regulations	Agency office responsible
NAAQS NESHAPs NSPS	Office of Air Quality Planning and Standards
Toxic Pollutant Effluent Standards EPA Point Source Effluent Standards Pretreatment Standards Harmful Quantities of Hazardous Substances	Assistant Administrator for Water and Hazardous Materials
Mobile Source Emissions Standards	Office of Mobile Source Air Pollution Control
Interim Primary and Secondary Drinking Water Standards	Office of Water Supply
OSHA Air Standards	[a]Occupational Safety and Health Administration Dir. of Health Stand. Program
Standards for Protection Against Radiation Effluent Limits for Radionuclides Nuclear Fuel Cycle Regulations	Office of Radiation Programs
Limits for Burial of Radionuclides	[a]Nuclear Regulatory Commission
Toxic Substances Control Act Regulations	Assistant Administrator for Toxic Substances
Pesticide Regulations	Office of Pesticide Programs
Noise	Office of Noise Abatement and Control
Solid Waste Regulations	Office of Solid Waste

[a] Not under EPA.

U.S. ENVIRONMENTAL PROTECTION AGENCY

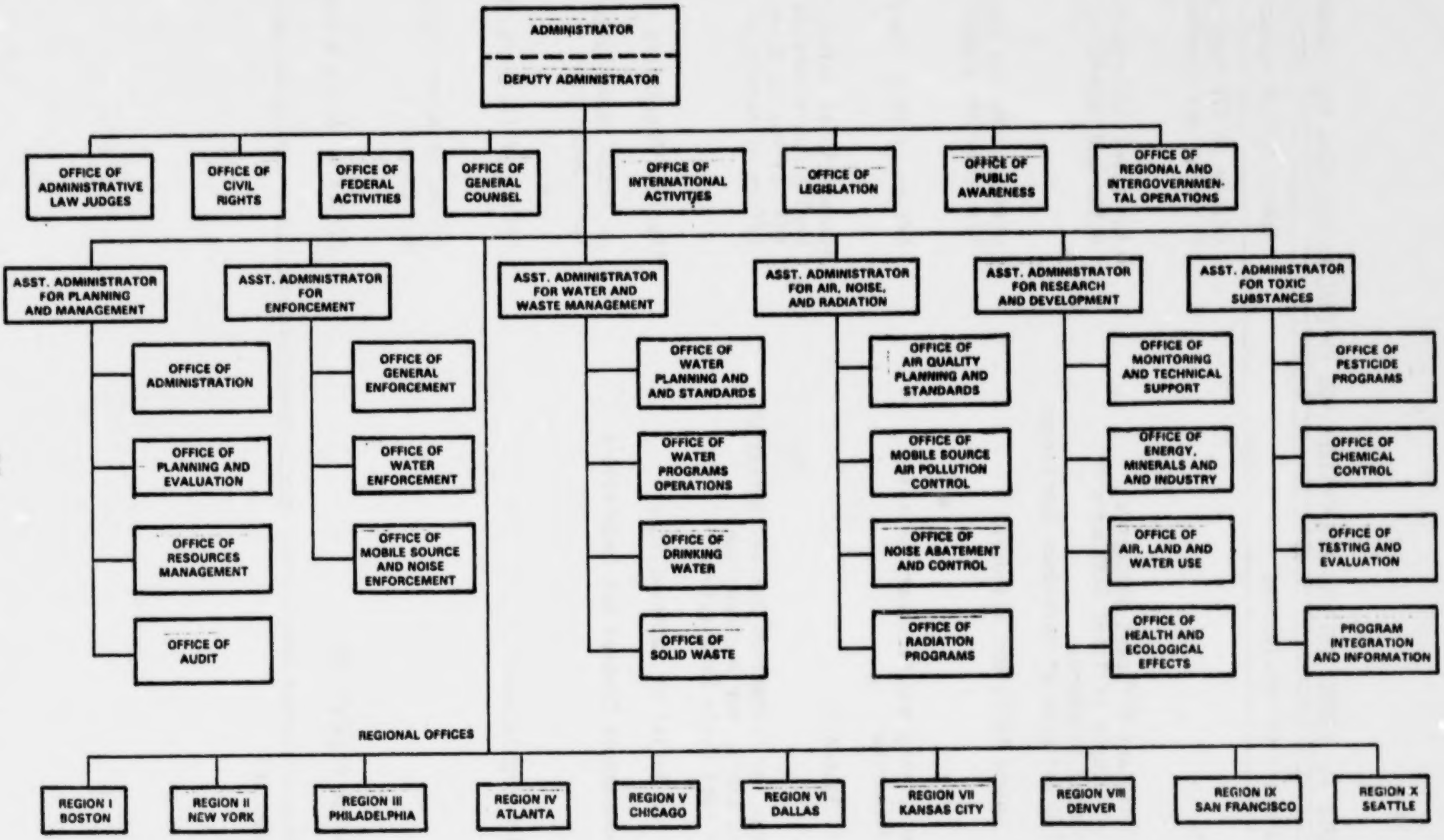

ADMINISTRATOR
DEPUTY ADMINISTRATOR
OFFICE OF ADMINISTRATIVE LAW JUDGES
OFFICE OF CIVIL RIGHTS
OFFICE OF FEDERAL ACTIVITIES
OFFICE OF GENERAL COUNSEL
OFFICE OF INTERNATIONAL ACTIVITIES
OFFICE OF LEGISLATION
OFFICE OF PUBLIC AWARENESS
OFFICE OF REGIONAL AND INTERGOVERNMENTAL OPERATIONS
ASST. ADMINISTRATOR FOR PLANNING AND MANAGEMENT
OFFICE OF ADMINISTRATION
OFFICE OF PLANNING AND EVALUATION
OFFICE OF RESOURCES MANAGEMENT
OFFICE OF AUDIT
ASST. ADMINISTRATOR FOR ENFORCEMENT
OFFICE OF GENERAL ENFORCEMENT
OFFICE OF WATER ENFORCEMENT
OFFICE OF MOBILE SOURCE AND NOISE ENFORCEMENT
ASST. ADMINISTRATOR FOR WATER AND WASTE MANAGEMENT
OFFICE OF WATER PLANNING AND AND STANDARDS
OFFICE OF WATER PROGRAMS OPERATIONS
OFFICE OF DRINKING WATER
OFFICE OF SOLID WASTE
ASST. ADMINISTRATOR FOR AIR, NOISE, AND RADIATION
OFFICE OF AIR QUALITY PLANNING AND STANDARDS
OFFICE OF MOBILE SOURCE AIR POLLUTION CONTROL
OFFICE OF NOISE ABATEMENT AND CONTROL
OFFICE OF RADIATION PROGRAMS
ASST. ADMINISTRATOR FOR RESEARCH AND DEVELOPMENT
OFFICE OF MONITORING AND TECHNICAL SUPPORT
OFFICE OF ENERGY, MINERALS AND AND INDUSTRY
OFFICE OF AIR, LAND AND WATER USE
OFFICE OF HEALTH AND ECOLOGICAL EFFECTS
ASST. ADMINISTRATOR FOR TOXIC SUBSTANCES
OFFICE OF PESTICIDE PROGRAMS
OFFICE OF CHEMICAL CONTROL
OFFICE OF TESTING AND EVALUATION
PROGRAM INTEGRATION AND INFORMATION
REGIONAL OFFICES
REGION I BOSTON
REGION II NEW YORK
REGION III PHILADELPHIA
REGION IV ATLANTA
REGION V CHICAGO
REGION VI DALLAS
REGION VII KANSAS CITY
REGION VIII DENVER
REGION IX SAN FRANCISCO
REGION X SEATTLE

TABLE 5. STRUCTURE OF ENVIRONMENTAL PROTECTION AGENCY

TABLE 6. OFFICES AND ORGANIZATIONS MAKING RECOMMENDATIONS TO REGULATORY AGENCIES

National Council on Radiation Protection and Measurements
7910 Woodmont Avenue
Washington, D.C. 20014

International Commission on Radiation Protection
Clifton Avenue
Sutton, Surrey, SM2 5PU, England

National Institute for Occupational Safety and Health
5600 Fisher Lane
Rockville, Maryland 20852

American Conference of Governmental Industrial Hygienists
1014 Broadway
Cincinnati, Ohio 45202

American National Standards Institute
1430 Broadway
New York, New York 10018

Department of Energy
Washington, D.C. 20585

TSCA Interagency Commission
Office of Toxic Substances
Washington, D. C. 20460

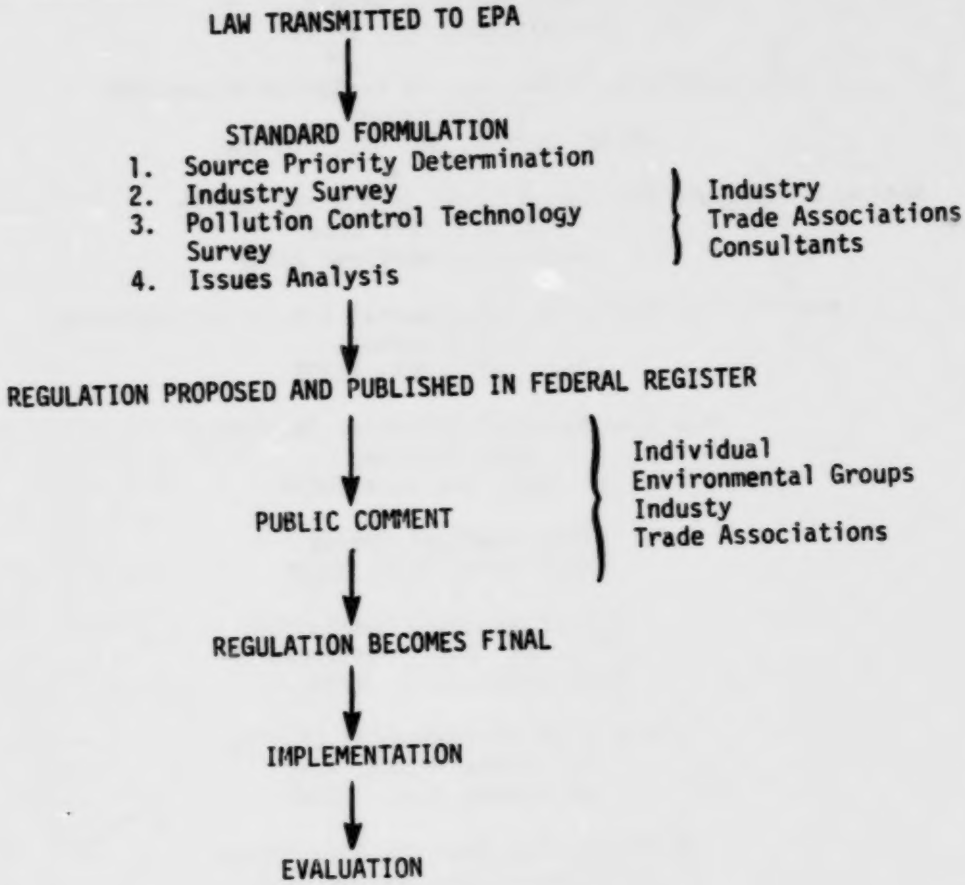
Council on Environmental Quality
722 Jackson Place, N.W.
Washington, D.C. 20006

Manufacturing Chemists Association
1825 Connecticut Avenue, N.W.
Washington, D.C. 20009

National Fire Protection Association
470 Atlantic Avenue
Boston, Massachusetts 02210

National Cancer Institute
Bethesda, Maryland 20014

TABLE 7. PROCEDURE FOR PROMULGATING REGULATIONS[a]


LAW TRANSMITTED TO EPA
STANDARD FORMULATION
1. Source Priority Determination
2. Industry Survey
3. Pollution Control Technology Survey
4. Issues Analysis
Industry
Trade Associations
Consultants
REGULATION PROPOSED AND PUBLISHED IN FEDERAL REGISTER
PUBLIC COMMENT
Individual
Environmental Groups
Industy
Trade Associations
REGULATION BECOMES FINAL
IMPLEMENTATION
EVALUATION

[a] New Stationary Source Performance Standards used as an example.

TABLE 8. REGULATIONS CATEGORIES LISTING EXISTING REGULATIONS WITH QUANTITATIVE ENFORCEABLE CONTROL LIMITS

National Primary and Secondary Ambient Air Standards
Mobile Source Emission Standards
National Emission Standards for Hazardous Air Pollutants
New Stationary Source Performance Standards
Toxic Pollutants Effluent Standards
EPA Point Source Effluent Standards
Pretreatment Standards
National Interim Primary and Secondary Drinking Water Standards
Occupational Safety and Health Administration Limitations for Toxic and Hazardous Substances in Workplace Air
Effluent Limits for Radionuclides
Nuclear Fuel Cycle Regulations
Limits for Burial of Radionuclides
Toxic Substances Control Act Regulations on PCBs and Fully Halogenated Chlorofluoro Alkanes
Pesticide Tolerances Levels on Agricultural Commodities
Noise Regulations

CATEGORY AND PROPOSED REGULATIONS

Hazardous Waste Regulations

TABLE 9. POLLUTANTS CONTROLLED BY FEDERAL REGULATIONS

	Consent Decree List (4.2)	NAAQS (3.1)	NESHAPs (3.4)	NSPS (3.3)	Mobile Source Standards (3.2)	Toxic Pollutant Standards (4.5)	Effluent Standards (4.3)	Hazardous Substances (4.6)	Drinking Water Standards (5.1)	OSHA (6.3)	Pesticide Tolerances (9.2)	TSCA (8.0)	Radiation Regulations (7.1)	Ocean Dumping Criteria (12.2)
Acenaphthene	X													
Acetaldehyde								X		X				
Acetic acid, anhydride								X		X				
Acrolein	X							X		X				
Acrylonitrile	X							X		X				
Aldrin/dieldrin	X					X		X		X	X			
Allyl alcohol								X		X				
Aluminum and compounds							X	X		X				
Ammonia and compounds	X						X	X		X				
Aniline								X		X				
Antimony and compounds	X							X		X				
Arsenic and compounds	X						X	X	X	X				
Asbestos	X		X				X			X				
Barium							X	X	X	X				
Benzene	X									X				X
Benzidine	X					X				X				
Benzyl chloride								X		X				
Beryllium and compounds	X		X					X		X				
Butyl acetate								X		X				
Butyl amine								X		X				
Cadmium and compounds	X					X	X	X	X	X				X
Calcium compounds								X		X				
Captan								X		X	X			
Carbaryl								X		X	X			
Carbon monoxide		X		X	X					X				
Carbon tetrachloride	X									X				
Chlordane	X							X		X	X			
Chlorinated benzenes	X							X		X				
Chlorinated ethanes	X													
Chlorine and chloride compounds							X	X	X	X				
Chloroalkyl ethers	X													
Chlorinated naphthalene	X													
Chlorinated phenols	X													
Chloroform								X		X				
Chlorosulfonic acid								X						
Chromium and compounds	X						X	X	X	X				
Cobalt								X		X				
Copper and compounds	X						X	X	X	X	X			
Cresol								X		X				
Cyanides	X					X	X	X		X	X			
DDT and metabolites	X					X		X		X	X			
Diazinon								X			X			
Dichlorobenzenes	X									X				
Dichlorobenzidines	X													
Dichloroethylenes	X													
Dichloropropane and dichloropropene	X													
Dichlorvos								X		X				
Diethylamine								X		X				
Dimethylamine								X		X				

TABLE 9. (continued)

	Consent Decree List (4.2)	NAAQS (3.1)	NESHAPs (3.4)	NSPS (3.3)	Mobile Source Standards (3.2)	Toxic Pollutant Standards (4.5)	Effluent Standards (4.3)	Hazardous Substances (4.6)	Drinking Water Standards (5.1)	OSHA (6.3)	Pesticide Tolerances (9.2)	TSCA (8.0)	Radiation Regulations (7.1)	Ocean Dumping Criteria (12.2)
2,4-Dimethylphenol	X													
Dinitrobenzene								X		X				
Dinitrotoluene	X									X				
Diphenylhydrazine	X						X							
Diquat								X		X	X			
Endosulfan and metabolites	X							X		X	X			
Endrin and metabolites	X					X		X	X	X	X			
Ethyl benzene	X									X				
Ethylene diamine								X		X				
Fecal coliform							X							
Fluoranthene	X													
Fluoride				X			X		X	X				
Fluorocarbons												X		
Fumaric acid								X						
Gold							X							
Guthion								X		X	X			
Haloethers	X													
Halomethanes	X													
Heptachlor and metabolites	X							X		X	X			
Heyachlorobutadiene	X													
Hexachlorocyclonexane	X													
Hexachlorocyclopentadiene	X									X				
Hydrocarbons		X		X	X					X				
Hydrochloric acid								X		X				
Hydrogen sulfide, sulfide									X	X				
Iridium							X							
Iron and compounds							X		X	X				
Isophorone	X									X				
Isopropanolamine								X		X				
Lead and compounds	X	X					X	X	X	X	X			
Lindane								X	X	X	X			
Malathion								X		X	X			
Manganese							X		X	X	X			
Mercury and compounds	X		X			X	X	X	X	X				X
Methoxychlor								X	X	X	X			
Methyl mercaptan								X		X				
Naled								X			X			
Naphthalene	X							X		X				
Nickel and compounds	X						X	X		X				
Nitrobenzene	X							X		X				
Nitrogen oxides, nitrates		X		X	X		X	X	X	X				
Nitrophenols	X							X						
Nitrosamines	X													
Oil and grease							X			X				X
Organohalogens														X
Osmium							X			X				
Ozone	X									X				
PAH	X													

TABLE 9. (continued)

	Consent Decree List (4.2)	NAAQS (3.1)	NESHAPs (3.4)	NSPS (3.3)	Mobile Source Standards (3.2)	Toxic Pollutant Standards (4.5)	Effluent Standards (4.3)	Hazardous Substances (4.6)	Drinking Water Standards (5.1)	OSHA (6.3)	Pesticide Tolerances (9.2)	TSCA (8.0)	Radiation Regulations (7.1)	Ocean Dumping Criteria (12.2)
Palladium							X							
Parathion and metabolites							X	X		X	X			
Particulates		X		X						X				
Pentachlorophenol	X							X		X				
Pesticides (not listed)								X			X			
Phenol	X						X	X		X				
Phosgene								X		X				
Phosphorus							X	X		X				
Phthalate esters	X													
Platinum							X			X				
Polychlorinated biphenyls (PCbs)	X					X	X			X		X		
Radioactive materials													X	X
Radium							X						X	
Rhodium							X			X				
Ruthenium							X							
Selenium and compounds	X						X	X	X	X				
Silver and compounds	X						X		X	X				
Strontium chromate								X	X				X	
Strychnine								X		X	X			X
Sulfur dioxide		X		X						X				
Sulfuric acid sulfate				X			X	X	X	X				
Sulfur monochloride								X		X				
Sulfur (total reduced)				X										
2,4,5-T acid and esters								X		X	X			
TDE								X			X			
2,3,7,8-Tetrachlorodibenzo-p-dioxin (TCDD)	X													
Tetrachloroethylene	X								X					
Thallium and compounds	X								X					
Toluene	X								X					X
Toxaphene	X					X		X	X	X	X			
Trichloroethylene	X													
Tritium									X				X	
Uranium and compounds						X	X		X				X	
Vanadium pentoxide							X		X					
Vinyl chloride	X		X						X					
Water parameters (BOD, TSS, pH, COD)						X		X						X
Zinc and compounds	X					X	X	X	X	X				
Zirconium and compounds								X		X				

TABLE 10. INDUSTRIES SPECIFICALLY ADDRESSED BY FEDERAL REGULATIONS

	Subject to PSD review (3.5)	NESHAPS (3.4)	NSPS (3.3)	NRDC Vs EPA Settlement Agreement List (4)	Effluent standards (4.3)	Pretreatment standards (4.3)	Toxic pollutant effluent standards (4.5)	Proposed hazardous waste regulations (11.2)
Asbestos manufacturing		X			X			
Auto and other laundries				X				
Beryllium rocket motor firing		X						
Builders paper and board mill					X			
Canned and preserved fruits and vegetables					X			
Canned and preserved seafood processing					X			
Carbon black manufacture	X				X			
Cement manufacturing					X			
Portland Cement Plant	X		X					
Charcoal production facilities	X							
Chemical process plants	X							
Coal mining				X	X			
Coal preparation plants (Coal cleaning)	(X)		X					
Cooling water intake structures					X			
Dairy products processing					X			
Electronic component production							X	X
Electroplating				X	X	X		X
Explosives manufacturing					X			X
Feedlots					X			
Ferroalloy manufacturing			X		X			X
Fertilizer manufacture					X			
Phosphate fertilizer industry			X		X			
Fossil fuel fired steam generators (Boilers, power plants)	(X)		X	X	X	X		
Fuel conversion plants	X							
Glass fiber processing plants	X							
Glass manufacturing					X			
Grain mills (Grain elevators)			(X)		X			
Gum and wood chemicals manufacturing					X			
Hospitals					X			
Incinerators (Municipal)	(X)		X					
Sludge incinerators		X						
Ink formulating					X			X
Inorganic chemicals manufacturing				X	X	X		X
Chlorine production								X
Hydrofluoric acid plants	X							
Nitric acid plants			X					
Sulfuric acid plants	X		X					
Boric acid production								X
Antimony oxide production								X
Iron and steel manufacturing	X		X	X	X			X
Coking	X				X			X
Steel plants			X					
Lead acid storage battery production								X
Leather tanning and finishing				X	X	X		X
Machinery and mechanical products manufacturing				X				
Meat products					X			
Mercury cell chlor-alkali plants		X						
Mineral mining and processing					X			
Miscellaneous chemicals				X				
Lime manufacturing plants	X		X					
Nonferrous metals manufacturing			X	X	X	X		
Primary aluminum plants	X		X					
Primary zinc smelters	X		X					
Primary copper smelters	X		X					
Primary lead smelters	X		X					
Secondary lead smelters			X					
Secondary brass and bronze ingot production plants			X					
Secondary metal production	X							
Oil and gas extraction (offshore segment)					X			X
Ore mining and dressing				X	X			
Mercury ore processing		X						
Taconite ore processing	X							
Organic chemicals manufacturing				X	X			X
Vinyl chloride production		X						X
Benzidine manufacturers and applicators							X	
Polychlorinated biphenyls manufacturers							X	

TABLE 10. (continued)

	Subject to PSD review (3.5)	NESHAPS (3.4)	NSPS (3.3)	NRDC vs EPA Settlement Agreement List (4)	Effluent standards (4.3)	Pretreatment standards (4.3)	Toxic pollutant effluent standards (4.5)	Proposed hazardous waste regulations (11.2)	
Paint formulation				X	X			X	
Paving and roofing materials (tars and asphalt)				X	X				
Asphalt concrete plants			X						
Pesticide chemicals manufacturing					X				
Aldrin/dieldrin manufacturers and formulators							X		
DDT, DDD, DDE manufacturers and formulators							X		
Toxaphene manufacturers and formulators							X		
Petroleum refining	X		X	X	X	X		X	
Petroleum storage and transfer facilities	X		X						
Pharmaceutical manufacturing					X				
Phosphate manufacturing	(X)				X				
Photographic					X				
Plastics and synthetics manufacturing				X	X				
Printing				X					
Pulp, paper, and paperboard					X				
Pulp, paperboard, and converted paper products				X					
Kraft pulp mills	X		X						
Rubber manufacturing				X	X				
Sewage treatment plants			X						
Sintering plants	X								
Soap and detergent manufacturing				X	X				
Sugar processing					X				
Sulfur recovery plants (Petroleum refining)	X		(X)						
Textile industry				X	X	X			
Timber products processing				X	X	X			
Specific sources (>100 tons/y any pollutant)	X								
Any other source (>250 tons/y any pollutant)	X								

TABLE 11. HIERARCHY OF REGULATIONS BY POLLUTANT

Pollutant	Medium	Recommendation, regulation, or criteria	Value
Lead and compounds	Air	NAAQS	1.5 μg/m^3
		NIOSH	0.15 mg/m^3
		OSHA	50 μg/m^3
	Water	Interim Primary Drinking Water Standards	0.05 mg/ℓ
		Water Quality Criteria	0.05 mg/ℓ
		Effluent Standard (Iron and steel manufacturing, vacuum degassing)	0.100 mg/ℓ
		Pretreatment (Inorganic chemicals manufacturing, lead monoxide production	1.0 mg/ℓ
		Hazardous Substances (Lead fluoride)	454 kg
Nitrogen oxides, nitrates	Air	NAAQS	.100 mg/m^3
		NIOSH	1.8 mg/m^3
		OSHA	9 mg/m^3
		Mobile Source Standards (Low emission vehicle)	400 mg/vehicle mile
		NSPS (Fossil fuel fired steam electric power generator using gaseous fossil fuels)	86 mg/joule heat input
	Water	Interim Primary Drinking Water Standards	10 mg/ℓ
		Water Quality Criteria	10 mg/ℓ
		Effluent Standard (Iron and steel manufacture [open hearth])	0.0094 kg/kkg product
Arsenic	Air	NIOSH	2 μg/m^3
		OSHA	10 μg/m^3
	Water	Interim Primary Drinking Water Standards	0.05 mg/ℓ
		Water Quality Criteria	0.05 mg/ℓ
		Pretreatment (Timber products [wood preserving steam])	0.41 mg/ℓ
		Effluent Standards (Ore mining and dressing, ferroalloy ores)	0.5 mg/ℓ
		Hazardous Substances (Arsenic disulfide, pentoxide, trichloride, trioxide, trisulfide)	2270 kg
Cadmium and compounds	Air	NIOSH	.040 mg/m^3 TWA
		OSHA	0.1 mg/m^3
	Water	Interim Primary Drinking Water Standards	0.010 mg/ℓ
		Water Quality Criteria	0.010 mg/ℓ
		Effluent Standard (Ore mining and dressing [base and precious metals])	0.05 mg/ℓ
		Pretreatment Standard (Nonferrous metal manufacture)	0.2 mg/ℓ
		Ocean Dumping Criteria	0.6 mg/kg
		Hazardous Substances (Cadmium acetate, bromide, chloride)	45.5 kg
Chromium and compounds	Air	NIOSH	1 μg/m^3
		OSHA	100 μg/10
	Water	Interim Primary Drinking Water Standards	0.05 mg/ℓ
		Water Quality Criteria	0.05 mg/ℓ
		Effluent Standard (Iron and steel manufacturing, hot coatings-galvanizing)	.0026 mg/ℓ
		Pretreatment Standard (Electroplating)	0.09 mg/ℓ
		Hazardous Substances	454 kg
Mercury and compounds	Air	NIOSH	0.05 mg/m^3 TWA
		OSHA	0.1 mg/m^3
		NESHAP (Mercury ore, mercury cell processing facilities, chloroalkali plants)	2300 g/24 hr
		Effluent Standard (Ore mining and dressing [base and precious metals])	0.0001 mg/ℓ
	Water	Interim Primary Drinking Water Standards	0.002 mg/ℓ
		Water Quality Criteria	0.002 mg/ℓ
		Ocean Dumping Criteria	0.75 mg/kg
		Hazardous Substances (Mercurous cyanide)	.45 kg
Cyanide	Air	NIOSH	5 mg/cu m
		OSHA	10 ppm
	Water	Water Quality Criteria	5.0 μg/ℓ
		Effluent Standard (Ore mining and dressing [base and precious metals])	0.1 mg/ℓ
		Pretreatment Standard (Electroplating)	0.08 mg/ℓ
		Hazardous Substances (Mercurous cyanide)	.454 kg
Ammonia	Air	NIOSH	50 ppm
		OSHA	50 ppm
	Water	Water Quality Criteria	0.02 mg/ℓ
		Effluent Standard (Ore mining and dressing, uranium, radium, and vanadium ores)	100 mg/ℓ
		Pretreatment	100 mg/ℓ
		Hazardous Substances	45.4 kg

TABLE 11. (continued)

Pollutant	Medium	Recommendation, regulation, or criteria	Value
Endrin and metabolites	Air	OSHA	0.1 mg/m^3
		Toxic Pollutant Standard	0.004 µg/ℓ
	Water	Interim Primary Drinking Water Standards	0.0002 mg/ℓ
		Water Quality Criteria	0.0002 mg/ℓ
		Hazardous Substances	454 kg
Fluoride	Air	NIOSH	2.5 mg/m^3
		OSHA	2.5 mg/m^3
		NSPS (Phosphate fertilizer industry)	0.25 g/hr/kkg of equivalent P_2O_5 stored
	Water	Effluent Standard (Mineral mining and processing, industrial sand)	0.003 mg/ℓ
		Interim Primary Drinking Water Standards	1.4 mg/ℓ (26.3-32.5°C)
		Hazardous Substances (Ferric fluoride)	45.4 kg
Selenium and compounds	Air	OSHA	0.2 mg/m^3
	Water	Interim Primary Drinking Water Standards	0.01 mg/ℓ
		Water Quality Criteria	0.01 mg/ℓ
		Effluent Standard (Nonferrous metals manufacturing, primary zinc)	0.027 kg/kkg product
		Hazardous Substances (Selenium oxide)	454 kg
Beryllium	Air	NIOSH	2 $µg/m^3$
		OSHA	2 $µg/m^3$
		NESHAP	10 g/24 hr
	Water	Water Quality Criteria	11 µg/ℓ
		Hazardous Substances (Chloride, fluoride)	2270 kg
Carbon monoxide	Air	NAAQS	10 mg/m^3
		NIOSH	35 ppm
		OSHA	50 ppm
		Mobile Source Standards (Low emission vehicles)	0.7/vehicle mile
		NSPS (Petroleum refining, catalyst regenerator)	0.050% by volume
Chlorine, chloride	Air	NIOSH	0.5 ppm
		OSHA	1 ppm
	Water	Water Quality Criteria	2.0 µg/ℓ
		Effluent Standard (Steam electric power generating (generating unit)	0.2 µg/ℓ
		Hazardous Substances	4.54 kg
Copper and compounds	Air	OSHA (Fume)	0.1 mg/m^3
	Water	Water Quality Criteria	1.0 mg/ℓ
		Effluent Standard (Ore mining and dressing [base and precious metals])	0.15 mg/ℓ
		Pretreatment Standard (Inorganic chemicals manufacturing, copper sulfate production, nonferrous metals, secondary copper)	0.5 mg/ℓ
		Hazardous Substances	4.54 kg
Hydrocarbons	Air	NAAQS	160 $µg/m^3$
		NIOSH	350 mg/m^3
		OSHA (Pentane)	1000 ppm
		OSHA (n-Heptane, octane, n-hexane)	500 ppm
		Mobile Source Standards (Low emission vehicles)	0.08 g/vehicle mile
		NSPS (Storage vessels for petroleum liquid must have vapor recovery system)	
Phenol	Air	NIOSH	20 mg/m^3
		OSHA	5 ppm
	Water	Water Quality Criteria	1 µg/ℓ
		Effluent Standard (Ferroalloy manufacturing, covered electric furnaces and other smelting operations with wet air pollution control devices)	0.0002 kg/kkg product
Silver and compounds	Air	OSHA	0.01 mg/m^3
	Water	Interim Primary Drinking Water Standards	0.05 mg/ℓ
		Water Quality Criteria	0.05 mg/ℓ
		Pretreatment Standard	0.34 mg/ℓ
		Effluent Standard (Photographic processing)	429 mg/ℓ
Toxaphene	Air	OSHA	0.5 mg/m^3
	Water	Toxic Pollutants Standard	0.005 µg/ℓ
		Interim Primary Drinking Water Standards	0.005 mg/ℓ
		Water Quality Criteria	0.005 mg/ℓ
		Hazardous Substances	0.454 kg

TABLE 11. (continued)

Pollutant	Medium	Recommendation, regulation, or criteria	Value
Zinc and compounds	Air	NIOSH (Zinc oxide)	5 mg/m^3
		OSHA (Zinc oxide)	5 mg/m^3
	Water	Effluent Standard (Iron and steel manufacturing, vacuum degassing)	0.100 mg/ℓ
		Pretreatment Standard (Inorganic chemicals, aluminum sulfate production)	2.5 mg/ℓ
		Hazardous Substances (Zinc cyanide)	4.54 kg
Aldrin/dieldrin	Air	OSHA	0.25 mg/m^3-skin
	Water	Toxic Pollutant Standard	0.003 μg/ℓ
		Water Quality Criteria	0.003 μg/ℓ
		Hazardous Substances	0.454 kg
Asbestos	Air	NESHAP	No visible emissions
		NIOSH	100,000 fibers/m^3
		OSHA	10,000,000 fiber/m^3
	Water	Effluent Standard (Asbestos manufacturing)	No discharge
DDT	Air	OSHA	1 mg/m^3
	Water	Toxic Pollutant Standard	0.001 μg/ℓ
		Water Quality Criteria	0.002 μg/ℓ
		Hazardous Substances	0.454 kg
Lindane	Air	OSHA	0.15 mg/m^3
	Water	Interim Primary Drinking Water Standards	.004 mg/ℓ
		Water Quality Criteria	.004 mg/ℓ
		Hazardous Substances	0.454 kg
Methoxychlor	Air	OSHA	15 mg/m^3
	Water	Interim Primary Drinking Water Standard	0.1 mg/ℓ
		Water Quality Criteria	0.1 mg/ℓ
		Hazardous Substances	0.454 kg
Nickel and compounds	Air	NIOSH	0.15 mg/m^3
		OSHA	1 mg/m^3
	Water	Effluent Standard (Ore mining and dressing, mercury ore)	0.1 mg/ℓ
		Hazardous Substances (Nickel hydroxide)	454 kg
Parathion and metabolites	Air	NIOSH	0.05 mg/m^3
		OSHA	0.1 mg/m^3
	Water	Water Quality Criteria	0.04 μg/ℓ
		Hazardous Substances	.454 kg
Sulfide, hydrogen sulfide	Air	NIOSH	15 mg/m^3
		OSHA	20 ppm
	Water	Water Quality Criteria	2 μg/ℓ
		Effluent Standard (Leather tanning)	.1 mg/ℓ
Sulfur dioxide	Air	NAAQS	80 μg/m^3(1 yr)
		NSPS (liquid fossil-fuel fired steam generators)	0.340 ng/joule heat input
		NIOSH	0.5 ppm
		OSHA	5 ppm
Sulfuric acid	Air	NIOSH	1 mg/m^3 TWA
		OSHA	1 mg/m^3 TWA
		NSPS (Sulfuric acid plants)	0.075 kg/kkg acid produced
	Water	Hazardous Substances	454 kg
Barium	Air	OSHA	0.5 mg/m^3
	Water	Water Quality Criteria	1 mg/ℓ
		Hazardous Substances (Barium cyanide)	4.54 kg
Chlordane	Air	OSHA	0.5 mg/m^3
	Water	Water Quality Criteria	0.01 μg/ℓ
		Hazardous Substances	0.454 kg
Polychlorinated biphenyls (PCBs)	Water	Effluent Standard (Steam electric power generating [generating unit])	0 discharge
		Toxic Pollutant Standard	0.001 μg/ℓ
		Water Quality Criteria	0.001 μg/ℓ
Uranium	Air	OSHA	0.05 mg/m^3 (soluble) 0.25 mg/m^3 (insoluble)
	Water	Effluent Standard (Ore mining and dressing, uranium, radium, and vanadium ores)	2.0 mg/ℓ
		Hazardous Substances	2270 kg
Endosulfan and metabolites	Water	Water Quality Criteria	.001 μg/ℓ
		Hazardous Substances	0.454 kg
Manganese and compounds	Water	Water Quality Criteria	50 μg/ℓ
		Effluent Standard (Iron and steel manufacturing, vacuum degassing)	0.100 mg/ℓ
Strychnine	Air	OSHA	0.15 mg/m^3
	Water	Hazardous Substances	4.54 kg

TABLE 12. PROJECTED NEW REGULATORY ACTIVITY AND PROPOSED REGULATIONS[a]

Category of regulations	Proposed regulatory activity
NAAQS	Ozone, primary and secondary In revision, carbon monoxide, sulfur oxides, particulates, nitrogen oxides.
Mobile Source Standards NSPS	Proposed--1981 mobile source standards for light duty vehicles and light duty trucks. A list of 72 issues to be addressed by future NSPS or NESHAPs regulations was proposed. The first five of these are synthetic organic chemicals manufacturing, carbon black, industrial surfact coating (cans), petroleum refining (fugitive sources), industrial surface coating (paper)
NESHAPs	Proposed--vinyl chloride To be proposed--benzene --asbestos from crushed stone --arsenic --coke oven emissions
Pretreatment standards Harmful quantities of hazardous substances	Electroplating industries. There is a list of 28 substances to be considered for future regulation among these are adipic acid, n-butyl phthalate, carbofuran, carbon tetrachloride, crotonaldehyde, etc.
Secondary drinking water standards	Chloride Color Copper Corrosivity Foaming agents Hydrogen sulfide Iron Manganese Odor pH Sulfate TDS Zinc
Primary drinking water standards	Trihalomethanes and other synthetic organic chemicals
OSHA	A new policy concerning carcinogens listed 276 chemicals for consideration for control under a new OSHA program for carcinogens.

[a] Additional references on these proposed regulations will be presented in the section of the report dealing with the specific regulation.

TABLE 12. PROJECTED NEW REGULATORY ACTIVITY AND PROPOSED REGULATIONS (cont'd)

Category of regulations	Proposed regulatory activity
TSCA	Substances under study are alkyl epoxides, alkyl phthalate, chlorinated benzenes, chlorinated paraffins, chloromethane, cresols, hexachloro-1,3-butadiene, nitrobenzene, toluene, and xylenes.
Pesticides	There are 38 pesticide chemicals under consideration for classification for restricted use.
Noise	Noise regulations have been proposed for the following categories: crawler tractors, wheel loaders, wheel tractors, buses, motorcycles, motorcycle aftermarket exhaust systems, truck mounted solid waste compactors, and the labeling of hearing protectors.
Solid waste	There is an entire program for the control of hazardous waste proposed. Among the issues addressed are air emission standards from solid waste, permissible concentrations of hazardous substances in solid waste, and processes producing hazardous wastes.
NEPA	New guidelines for simplifying the drafting and reviewing of Environmental Impact Statements have been proposed.

3.0 CLEAN AIR ACT

In October 1948, 20 deaths and 6,000 cases of illness in the industrial community of Donora, Pennsylvania, were attributed to a prolonged period of air pollution. After this incident focused the public's attention on health problems associated with air pollution, seven years passed before there was any Federal legislative response to the problem.

In 1955 the Congress provided temporary authority for research, demonstration, and testing of air pollution control measures. This authority was extended several times. In 1963 this authority was made permanent by the Clean Air Act (CAA). In accordance with the CAA, however, the enforcement authority remained with the States. The Department of Health, Education, and Welfare, at the request of the State, could hold a public hearing on air pollution within the State. After a conference with the offending polluters, HEW could finally initiate Federal court proceedings against them. Only if the pollution originated in one State and affected a population in another State could the Department act on its own initiative without the permission of the involved State.

In 1965 the Congress passed the Motor Vehicles Air Pollution Control Act. This provided that HEW establish Federal regulations on the emissions from 1968 model vehicles.

In response to increasing public pressure, the Air Quality Act of 1967 was passed. It was modeled on the Water Quality Act of 1965. It established Federal criteria for pollution control, but the States retained primary authority for setting standards and enforcing them. According to the procedure established in this act, HEW established air quality control regions (AQCRs) for the States and set ambient air quality criteria.

The State would have 90 days to file a letter of intent to comply with the established criteria. The State then was given an additional 180 days to adopt specific standards to meet the Federal criteria. If these standards were approved, the State was given 360 more days to

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submit an implementation plan for enforcing those standards. In the event of a failure to comply with this scheme, Federal authority could promulgate regulations for the State. If this occurred, the State would be given an additional six months to try to set its own standards.

In order to accelerate the program of air pollution control and abatement, Congress passed the Clean Air Act Amendment of 1970. These amendments provided for increased Federal (EPA) control in the area of air pollution. They established Standards (NAAQS), to be implemented under State Implementation Plans (SIP) in the 247 air quality control regions designated. The amendments provided for national standards to reduce emissions standards for new motor vehicles and new motor vehicle engines by 90 percent. Specific industrial source categories were addressed under standards of performance for new stationary sources (NSPS). National Emissions Standards for Hazardous Air Pollutants (NESHAP) were also promulgated under these amendments. The enforcement procedure was shortened considerably. If a source within a State did not comply with the appropriate standard and the State took no action to assure compliance, the EPA notified the State of the failure. If the State then took no action within 30 days, the EPA could issue an order to comply or bring civil action in the courts against the offending polluter. The Clean Air Act Amendments of 1977 outline additional legislation aimed at achieving and maintaining the NAAQS. The last amendments institute Prevention of Significant Deterioration (PSD) regulations and Non-Attainment (NA) rules. Three classes of air quality regions are defined and incremental allowances for increasing baseline concentrations of specific pollutants (particulates and SO_2) are specified for each class. Each of the ACQRs is charged with the responsibility of meeting the NAAQS. Various aspects of the Clean Air Act are presented in more detail in subsections 3.1, 3.2, 3.3, 3.4, and 3.5.

3.1 NATIONAL PRIMARY AND SECONDARY AMBIENT AIR QUALITY STANDARDS

The first National Primary and Secondary Ambient Federal Air Quality Standards and a description of the "reference methods" to be used in sampling and measurements were published on April 30, 1971 in 42 CFR 410, recodified to 40 CFR 50 on November 25, 1972. Primary standards were set for the protection of health. Secondary standards were set for the protection of welfare, which, in the words of the Act," included, but was not limited to, effects on soils, water, crops, vegetation, manmade materials, animals, wildlife, weather, visibility, and climate, damage to and deterioration of property, and hazards to transportation, as well as effects on economic values and on personal comfort and well being."

Pollutants for which NAAQS have been established may be referred to as "criteria pollutants." Criteria air pollutants are those substances in the air which are reasonably anticipated to endanger public health or welfare and which are released to the air by numerous or diverse sources. Criteria documents containing the latest scientific knowledge on the kind and extent of public health and welfare problems caused by the presence of pollutants in the air have been prepared for each criteria pollutant. The NAAQS for each criteria pollutant is proposed with issuance of the criteria document. The NAAQS promulgated under the Clean Air Act Amendments of 1970 address particulate matter, sulfur dioxide, carbon monoxide, photochemical oxidants, hydrocarbons (non-methane), and nitrogen dioxide. A primary standard for lead was added in September 1978. The standards for photochemical oxidants were amended in February 1979. Table 13 summarizes the current and proposed NAAQS.

Currently, five criteria documents for criteria pollutants are being revised. These pollutants and the projected dates of issuance of the revised documents are listed in Table 14. Consideration is being given to merging the annual and short-term nitrogen oxide standards. Pollutants that are under consideration as possible candidates for additional NAAQS include cadmium, arsenic, POM, and radioactive pollutants.

Further information regarding recent developments pertaining to NAAQS may be obtained from the Office of Strategies and Air Standards Division, Environmental Protection Agency, Research Triangle Park, N.C. 27711, 919/541-5204, FTS 8-629-5204.

In order to make the control of air quality a more reasonable task, the United States has been divided into 247 AQCRs. The various AQCRs are identified in Table 15. Each State has the responsibility for achieving the NAAQS in the AQCRs within its jurisdiction.

States are also given the authority by EPA to promulgate regulations to control point source air pollution within State borders in order to meet ambient standards. Such regulations must be at least as stringent as Federal regulations. Each State must submit a SIP specifying the manner in which the NAAQS will be achieved and maintained within nine months after the Federal criteria are issued then EPA has four months to approve or reject the plan. If a State fails to adopt regulations that meet Federal criteria or fails to enforce the regulations, authority reverts to the United States Environmental Protection Agency.

3.2 NATIONAL EMISSIONS STANDARDS (MOBILE SOURCES)

Under the National Emissions Standards Act (included as part of the Clean Air Act), EPA is responsible for prescribing and enforcing standards applicable to the emissions of air pollutants from motor vehicles or motor vehicle engines produced after 1976. Emissions from aircraft engines are also controlled under this act. Standards are promulgated for the protection of public health or welfare. Pollutants addressed by these standards include carbon monoxide, hydrocarbons, and oxides of nitrogen. Standards applicable to the various 1977-1981 model vehicles are tabulated in Table 16. The exhaust emissions standards for light duty vehicles are given in 40 CFR, Part 86. Those applicable to aircraft are in 40 CFR, Part 87. Exhaust emissions for aircraft and aircraft engines are tabulated in Table 17.

The Clean Air Act also mandates EPA to set requirements for fuels and fuel additives to be used in mobile sources in order to further reduce the pollution from this source. The CAA also provides incentives for encouraging the use of mass transit and for the formation of carpools in order to reduce the number of private vehicles in use.

3.3 NEW STATIONARY SOURCE PERFORMANCE STANDARDS

The Clean Air Act Amendments of 1970 require EPA to publish a list of categories of stationary sources (i.e., industries), which include those sources judged to cause or contribute significantly to air pollution and which may be reasonably anticipated to endanger the public health or welfare. Proposed regulations for specific source categories are to be published within 120 days after inclusion in the source listing. Final adoption of new stationary source standards for each source category follows a public comment. All States are required to submit plans for establishing and implementing standards of performance consistent with these Federal guidelines. The listing of stationary sources to be controlled under this part of the Clean Air Act is to be updated regularly, and existing standards are to be reviewed systematically and revised as technology advances. These standards of performance apply to sources for which construction began after the publication of applicable standards.

The term "standard of performance" means a control level for emissions of air pollutants that reflects the degree of emission limitation achievable through the application of the best system of emission reduction which (taking into account the cost of achieving such reduction) EPA determines has been adequately demonstrated. EPA does not attempt to define averages or representative emission rates. Consideration of cost is applied as a modifier to avoid extremes. To be adequately demonstrated, the pollutant control technology must be available at a cost and at a time which EPA determines to be reasonable.

Individual standards are not directly designed to achieve any ambient air quality goals. They are designed to reflect the best technology for each individual source. The long-range goal and overriding purpose of the collective body of standards is to prevent new pollution problems from developing. To achieve this end, the standards must be an incentive for technological change.

NSPS regulations currently adopted include three types. Most of the regulations establish allowable emission limitations for a given source category. Other regulations require the achievement of a specified percentage reduction in emissions, and in cases where it is not feasible to prescribe or enforce a standard of performance of the types, EPA may promulgate designs, equipment, work practices, operational standards, or combination thereof, that reflect the best environmental control.

New stationary source performance standards are located at 40 CFR, Part 60, for 26 source categories. Pollutants addressed in these standards include particulates, sulfur dioxide, nitrogen oxides, sulfuric acid mist, carbon monoxide, hydrocarbons, fluorides, and total reduced sulfur. Table 18 presents the New Stationary Source Performance Standards. On September 1978, EPA proposed New NSPS standards for fossil fuel fired steam generator and primary aluminum smelting. These proposed limits are found in Table 19.

A list of priorities was added at 40 CFR, Part 60, on August 31, 1978, designating source categories to be addressed by either new or revised NSPSs or NESHAPs (see Section 3.4). This list is given in Table 20 which includes the various source categories along with their assigned priority numbers as specified in the proposed amendment to the regulations. The organic chemicals industry processes (Priority 1) considered most likely candidates for NSPS or NESHAP are listed in Table 21.

3.4 NATIONAL EMISSIONS STANDARDS FOR HAZARDOUS AIR POLLUTANTS (NESHAP)

EPA is required under the Clean Air Act to establish National Emissions Standards for Hazardous Air Pollutants (NESHAPs). The purpose of these standards is to limit emissions of certain very hazardous pollutants from specific source categories. Pollutants addressed by these standards have been shown to cause or contribute to an increase in human mortality or to an increase in serious irreversible or incapacitating reversible illness. The Clean Air Act Amendment of 1970 requires EPA to publish a list of hazardous air pollutants to be addressed by NESHAPs. Proposed regulations for a hazardous pollutant are to be published within 180 days after inclusion of the pollutant in the EPA list. After a public hearing and comment period, proposed regulations judged to provide an ample margin of safety to protect the public health may be adopted. In cases where it is not feasible to prescribe or enforce a hazardous emission standard, EPA may promulgate designs, equipment, work practices, operational standards, or a combination thereof, to protect public health. Authority to enforce NESHAPs may be delegated to States that have submitted to EPA a plan for enforcing such regulations.

Current NESHAPs pertain to asbestos, beryllium, mercury, and vinyl chloride. The emissions standards for mercury and beryllium are derived from ambient concentrations which are considered to be safe, i.e., levels that would not adversely affect human health. For asbestos and vinyl chloride a safe concentration has not been specified, and standards are established to minimize exposure to the population from certain operations. Current enforceable NESHAPs as specified in 40 CFR, Part 61 are summarized in Table 22. Revised NESHAPs for vinyl chloride have been proposed and are included.

In addition to the standards summarized in Table 22, EPA has designated or is considering designating additional pollutants and sources as hazardous. Arsenic, benzene, coke oven emissions, lead, fluorides, cadmium, POM, and asbestos from crushed stone are under study for NESHAPs. Additional information pertaining to the current status of NESHAPs may be obtained from the Emissions Standards and Engineering Division, Environmental Protection Agency, Research Triangle Park, N.C. 27711, 919/541-5271, FTS 8-629-5271.

3.5 PREVENTION OF SIGNIFICANT DETERIORATION

The Clean Air Act Amendments of 1977 instituted a new method of achieving and maintaining NAAQS. Under these amendments, States were required to submit by December 6, 1977, for each Air Quality Control Region, a report on the attainment status of each pollutant addressed by NAAQS. AQCRs shown to possess air quality cleaner than that specified by the NAAQS for SO_2 or for particulates will be designated a Prevention of Significant Deterioration area for that pollutant. AQCRs in which the air quality does not meet the NAAQS are designated Non-Attainment (NA) areas. It is possible for an AQCR to have PSD regulations regarding one pollutant and NA regulations for the other.

Regions designated PSD are assigned one of three clean air classifications. PSD increment limitations are specified for each of the three Clean Air Act classifications for SO_2 and for particulates. Criteria for clean air class designations are presented in Table 23. The specific PSD permitted increments are listed in Table 24. In Class I regions a new source may receive special permission for additional allowances for SO_2 emissions on 18 days per year. These allowances, listed in Table 25, are in addition to the normally allowed 24 hours and 3 hours SO_2 control limitation. The excess emission permitted depends upon the terrain and stack height of the particular source involved.

New construction of certain major stationary sources is subject to PSD review in areas regulated by PSD regulations. Stationary sources affected by the PSD review are listed in Table 26. Before construction it must be shown that emissions from the new facility will not cause an increase in the ambient air concentrations greater than allowed increments (as specified in Table 24) and that the ambient concentration will remain below the NAAQS. The PSD allowed increment applies to all sources in an AQCR for all future times. It is therefore unlikely that an individual new facility will be permitted to use an entire increment.

For AQCRs not meeting the NAAQS for a specific pollutant, industrial expansion is regulated by NA rules. Construction or expansion of major stationary sources in NA areas are subject to EPA's emission offset policy as established in the 1977 Clean Air Act amendments. This requires expanding industrial facilities to reduce emissions at their own facilities to the lowest level possible and to obtain emission reductions from other plants in the affected AQCR so that the net ambient pollution levels are lowered. New facilities must also attain an emission level that is the Lowest Achievable Emission Rate (LAER).

TABLE 13. NATIONAL PRIMARY AND SECONDARY AMBIENT AIR QUALITY STANDARDS (40 CFR Part 50)

Pollutant	Type of standard	Averaging time	Frequency parameter	Concentration	
				$\mu g/m^3$	ppm
Carbon monoxide	Primary and secondary	1 hr	Annual maximum[a]	40,000	35
		8 hr	Annual maximum	10,000	9
Hydrocarbons (nonmethane)	Primary and secondary	3 hr (6 to 9 a.m.)	Annual maximum	160[b]	0.24[b]
Nitrogen dioxide	Primary and secondary	1 yr	Arithmetic mean	100	0.05
Photochemical oxidants[c]	Primary and secondary	1 hr	Annual maximum	160	0.08
Particulate matter	Primary	24 hr	Annual maximum	260	-
		24 hr	Annual geometric mean	75	-
	Secondary	24 hr	Annual maximum	150	-
		24 hr	Annual geometric mean	60[d]	-
Sulfur dioxide	Primary	24 hr	Annual maximum	365	0.14
		1 yr	Arithmetic mean	80	0.03
	Secondary	3 hr	Annual maximum	1,300	0.5
Lead	Primary	90 day		1.5	
Ozone	Primary and Secondary	1 hr		235	0.12

[a] Not to be exceeded more than once per year.

[b] As a guide in devising implementation plans for achieving oxidant standards.

[c] Expressed as ozone by the Federal Reference Method.

[d] As a guide to be used in assessing implementation plans for achieving the annual maximum 24-hour standard.

TABLE 14. CRITERIA DOCUMENTS IN REVISION AND PROJECTED ISSUANCE DATES

Criteria pollutant	Projected issuance date
Carbon monoxide	July 1979
Sulfur oxides	December 1980
Particulates	December 1980
Nitrogen oxides (Short-term)	November 1978
Nitrogen oxides (Annual)	June 1979

TABLE 15. IDENTIFICATION OF AIR QUALITY CONTROL REGIONS (AQCRs)

Alabama:	
Alabama and Tombigbee Rivers	1
Columbus-Phenix City	2
East Alabama	3
Metropolitan Birmingham	4
Mobile-Pensacola-Panama City-Southern Mississippi (Fla., Miss.)	5
Southeast Alabama	6
Tennessee River Valley-Cumberland Mountains (Tenn.)	7
Alaska:	
Cook Inlet	8
Northern Alaska	9
South Central Alaska	10
Southeastern Alaska	11
Arizona:	
Arizona-New Mexico Southern Border (N.Mex.)	12
Clark-Mohave	13
Four Corners (Colo., N.Mex., Utah)	14
Phoenix-Tucson	15
Arkansas:	
Central Arkansas	16
Metropolitan Fort Smith	17
Metropolitan Memphis	18
Monroe-El Dorado (La.)	19
Northeast Arkansas	20
Northwest Arkansas	21
Shreveport-Texarkana-Tyler (La., Okla., Texas)	22
California:	
Great Basin Valley	23
Metropolitan Los Angeles	24
North Central Coast	25
North Coast	26
Northeast Plateau	27
Sacramento Valley	28
San Diego	29
San Francisco Bay Area	30
San Joaquin Valley	31
South Central Coast	32
Southeast Desert	33
Colorado:	
Comanche	34
Four Corners (Ariz., N.Mex., Utah)	14
Grand Mesa	35
Metropolitan Denver	36
Pawnee	37
San Isabel	38
San Luis	39
Yampa	40
Connecticut:	
Eastern Connecticut	41
Hartford-New Haven-Springfield (Mass.)	42
New Jersey-New York-Connecticut (N.J., N.Y.)	43
Northwestern Connecticut	44
Delaware:	
Metropolitan Philadelphia (N.J., Pa.)	45
Southern Delaware	46
District of Columbia:	
National Capital (Md.)	47
Florida:	
Central Florida	48
Jacksonville-Brunswick (Ga.)	49
Mobile-Pensacola-Panama City-Southern Mississippi (Ala., Miss.)	5
Southeast Florida	50
Southwest Florida	51
West Central Florida	52
Georgia:	
Augusta-Aiken (S.C.)	53
Central Georgia	54
Chattanooga (Tenn.)	55
Columbus-Phenix City (Ala.)	2
Jacksonville-Brunswick (Fla.)	49
Metropolitan Atlanta	56
Northeast Georgia	57
Savannah-Beaufort (S.C.)	58
Southwest Georgia	59
Hawaii:	
Entire State	60
Idaho:	
Eastern Idaho	61
Eastern Washington-Northern Idaho (Wash.)	62
Idaho	63
Metropolitan Boise	64
Illinois:	
Burlington-Keokuk (Iowa)	65
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TABLE 16. EMISSION STANDARDS FOR CONTROL OF AIR POLLUTION FROM MOBILE SOURCES

Mobile Sources	Hydrocarbons				Carbon Monoxide				Nitrogen Oxides			
	1978	1979	1980	1981	1978	1979	1980	1981	1978	1979	1980	1981
Light duty vehicles[a]	1.5	1.5	0.41	0.41	15	15	7.0	3.4	2.0	2.0	2.0	1.0
Light duty truck[a]	2.0	1.7	1.7	1.7	20	18	18	18	3.1	2.3	2.3	2.3
Low emission vehicles[a]	0.08	--	--	--	0.7	--	--	--	0.4	--	--	--
Motorcycles[d]	5-14[e]	5-14[e]	5	5	--	17	12	12	--	--	--	--
Gasoline-fueled heavy duty[b,c] engine	--	1.5	1.5	1.5	40	25	25	25	16[f] --	10[f] or 9.5	10[f]	10[f]
Diesel-fueled heavy duty[b,c] engine	--	--	1.5	1.5	40	--	25	25	16	10[f] or 9.5	10[f] or 9.5	--

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[a] Values for standards reported in grams per vehicle mile.

[b] Values for standards reported in grams per brake horsepower.

[c] Opacity limitation-20% during acceleration mode; 15% during lugging mode; 50% maximum during either mode.

[d] Values for standards reported in gm/km.

[e] Dependent on displacement from 170-720 cc.

[f] Nitrogen oxide and hydrocarbons.

TABLE 17. GASEOUS EMISSION STANDARDS APPLICABLE TO NEWLY MANUFACTURED AIRCRAFT GAS TURBINE ENGINES

Engine class	Pollutant HC	 CO	 NOx	Effective Date
T-1 Turbojet/turbofan less than 8000 lbs thrust	1.6	9.4	3.7	Jan. 1, 1979
T-2 Turbojet/turbofan greater than 8000 lbs thrust (Except JT8D and JT3D)	0.8	4.3	3.0	Jan. 1, 1979
T-2*	0.4	3.0	3.0	Jan. 1, 1981
T-3 P&W JT3D	0.8	4.3	3.0	Jan. 1, 1979
T-4 P&W JT8D	0.8	4.3	3.0	Jan. 1, 1979
T-5*	1.8	7.8	5.0	Jan. 1, 1984
P_2 Turboprop engines	4.9	26.8	12.9	Jan. 1, 1979
T-5 Turbojet/turbofan engines for supersonic aircraft	3.9	30.1	9.0	Jan. 1, 1980
P_1 Piston engines	1.9	42.0	1.5	Dec. 30, 1979
APU Auxiliary power units	0.4	5.0	3.0	Jan. 1, 1979

*Newly certified aircraft engines

Note: "T" standards as: lb/1000 lbs thrust-hour/cycle
"P_2" standards as: lbs/1000 horsepower-hours/cycle
"P_1" standards as: lbs/1000 rated horsepower/cycle
APU standards as: lbs/1000 horsepower

TABLE 18. NEW STATIONARY SOURCE PERFORMANCE STANDARDS

New stationary source performance standards	Pollutant	No discharge in excess of regulation	Opacity
Subpart D--Fossil Fuel Fired Steam Generators Generating more than 63 million Kcal per hr heat input (250 million Btu/hr)	Particulate	43 ng/joule heat input (0.10 lb/million Btu) derived from fossil fuel	20%
	Sulfur dioxide	340 ng/joule heat input (0.80 lb/million Btu) derived from liquid fossil fuel	20%
		520 ng/joule heat input (1.2 lb/million Btu) derived from solid fossil fuel	
(When a lignite or a solid fossil fuel containing 25% by wt. or more of coal refuse is burned in combination with other fuels, the standard for nitrogen oxides does not apply.)	Nitrogen oxides	86 ng/joule heat input (0.20 lb/million Btu) derived from gaseous fossil fuel	
		130 ng/joule heat input (0.30 lb/million Btu) derived from liquid fossil fuel	
		300 ng/joule heat input (0.70 lb/million Btu) derived from solid fossil fuel (except lignite)	
		260 ng/joule heat input (0.60 lb/million Btu) derived from lignite or lignite and wood residue	
Subpart E--Incinerators	Particulate	0.18 g/dscm	
		0.08 gr/dscf corrected to 12% CO_2	
Subpart F--Portland Cement Plant Kiln	Particulate	0.15 kg/metric ton of feed (dry basis) to the kiln (0.30 lb/ton)	20%
Clinker cooler		0.050 kg/metric ton of feed (dry basis) to the kiln (0.10 lb/ton)	10%
Subpart G--Nitric Acid Plants	Nitrogen oxides	NO_2 1.5 kg/metric ton of acid produced (3.0 lb/ton)	10%
Subpart H--Sulfuric Acid Plants	Acid mist	0.075 kg.metric ton of acid produced (0.15 lb/ton)	10%
	Sulfur dioxide	2 kg/metric ton of acid produced (4 lb/ton)	
Subpart I--Asphalt Concrete Plants	Particulate	90 mg/dscm (0.04 gr/dscf)	20%
Subpart J--Petroleum Refineries Fluid catalytic Cracking unit Catalyst regenerator or incinerator-waste Heat boiler	Particulate	1.0 kg/1000 kg (1.0 lb/1000 lb) of coke burn-off in the catalyst regenerator	30%
Catalyst Regenerator	Carbon monoxide	0.050% by volume	
	Sulfur dioxide	No burning of fuel gas containing H_2S in excess of 230 mg/dscm (0.10 gr/dscf)	
Claus Sulfur Recovery Plant		0.025% by volume at 0% oxygen on a dry basis if emissions are controlled by an oxidation controls system or a reduction system followed by incineration	
		0.030% by volume of reduced sulfur compounds and 0.0010% by volume of hydrogen sulfide calculated as SO_2 at 0% oxygen on a dry basis if emissions are controlled by reduction not followed by incineration	
Subpart K--Storage Vessels for Petroleum Liquid	Hydrocarbons		
(Storage capacity greater than 151,412 liters or 40,000 gal.)	Vapor pressure 78 to 570 mm Hg	Vessel must be equipped with floating roof, vapor recovery system or equivalent	
	Vapor pressure >570 mm Hg (11.1 psia)	Vessel must be equipped with a vapor recovery system or its equivalent	

TABLE 18. (continued)

New stationary source performance standards	Pollutant	No discharge in excess of regulation	Opacity
Subpart L--Secondary Lead Smelters Blast or Reverberatory Furnace	Particulate	50 mg/dscm (0.222 gr/dscf)	20%
Pot Furnace more than 250 kg (550 lb) charging capacity			10%
Subpart M--Secondary Brass and Bronze Ingot Production Plants		50 mg/dscm (0.022 g/dscf)	20%
Reverberatory Furnace Production capacity of 1000 kg (2205 lb) or greater	Particulate	50 mg/dscm (0.022 g/dscf)	20%
Blast Furnace of 250 kg/hr (550 lb/hr) or greater production capacity, or			10%
Electric Furnace of 1000 kg (2205 lb) or greater production capacity			
Subpart N--Iron and Steel Plants	Particulate	50 mg/dscm (0.022 gr/dscf)	10%
Subpart O-Sewage Treatment Plants	Particulate	0.65 g/kg dry sludge input (1.30 lb/ton dry sludge input)	20%
Subpart P--Primary Copper Smelters Dryer	Particulate	50 mg/dscm (0.022 gr/dscf)	20%
Roaster, Smelting Furnace, or Copper Converter	Sulfur dioxide	0.065% by volume	
Subpart Q--Primary Zinc Smelters Sintering Machine	Particulate	50 mg/dscm (0.022 gr/dscf)	20%
Roaster	Sulfur dioxide	0.065% by volume	
Subpart R--Primary Lead Smelters Blast Furnace, Dross Reverberatory Furnace, or Sintering Machine	Particulate	50 mg/dscm (0.022 gr/dscf)	20%
Sintering Machine, Electric Smelting Furnace, or Converter	Sulfur dioxide	0.065% by volume	
Subpart S--Primary Aluminum Plants Vertical Stud Soderberg Plants, Horizontal Stud Soderberg Plants	Fluorides	Produced 1 kg/metric ton (2 lb/ton) of aluminum	
Potroom Groups at Prebake Plants		0.95 kg/metric ton (1.9 lb/ton) of aluminum produced	10%
Anode Bake Plants		0.05 kg/metric ton (0.1 lb/ton) of aluminum equivalent	20%
Subpart T--Phosphate Fertilizer Wet Process Phosphoric Acid Plants	Total fluorides	10 g/metric ton of equivalent P_2O_5 feed (0.020 lb/ton)	
Subpart U--Phosphate Fertilizer Industry: Superphosphoric Acid Plants	Total fluorides	5.0 g/metric ton of equivalent P_2O_5 feed (0.010 lb/ton)	
Subpart V--Phosphate Fertilizer Industry: Diammonium Phosphate Plants	Total fluorides	30 g/metric ton of equivalent P_2O_5 feed 0.060 lb/ton)	
Subpart W--Phosphate Fertilizer Industry: Triple Superphosphate Plants	Total fluorides	100 g/metric ton of equivalent P_2O_5 feed (0.20 lb/ton)	
Subpart X--Phosphate Fertilizer Industry: Triple Superphosphate Storage Facility	Total fluorides	0.25 g/hr/metric ton of equivalent P_2O_5 stored (5.0 x 10^{-4} lb/hr/ton)	
Subpart Y--Coal Preparation Plants Thermal Dryer	Particulate	0.070 g/dscm (0.031 gr/dscf)	20%
Pneumatic Coal Cleaning Equipment		0.040 g/dscm (0.018 gr/dscf)	10%
Processing, Conveying, Storage, Transfer, Loading			20%

TABLE 18. (continued)

New stationary source performance standards	Pollutant	No discharge in excess of regulation	Opacity
Subpart Z--Ferroalloy Production Facilities Electric Submerged Arc Furnace Control Device While silicon metal, ferro-silicon, calcuim silicon, or silicon-manganese zirconium is being produced	Particulate	0.45 kg/MW-hr (0.99 lb/MW-hr)	15%
While high-carbon ferrochrome, charge chrome, standard ferro-manganese, silico-manganese, calcium carbide, ferrochrome silicon, ferromanganese silicon, or silvery iron is being produced.		0.23 kg/MW-hr (0.51 lb/MW-hr)	15%
Dust Handling Equipment			10%
Electric Submerged Arc Furnace	Carbon monoxide	20% by volume (dry basis)	
Subpart AA--Steel Plants: Electric Arc Furnaces	Particulate		
From control device of Electric Arc Furnace		12 mg/dscm (0.0052 gr/dscf)	3%
From Shop			0%
From Dust-handling Equipment			10%
Subpart BB-Kraft Pulp Mills Recovery Furnaces	Particulate	0.10 g/dscm (0.044 gr/dscf) corrected to 8% oxygen	35%
Smelt Dissolving Tank		0.10 g/kg air-dried pulp (0.3 lb/ton air-dried pulp)	
Lime Kiln (burning gaseous fossil fuel)		0.15 g/dscm (0.067 gr/dscf)	
(burning liquid fossil fuel)		0.30 g/dscm (0.13 gr/dscf)	
Digester System, Brown Stock Washer System, Multiple-Effect Evaporator System, Black Liquor Oxidation System, Condensate Stripper System, Recovery Furnace or Lime Kiln	Total reduced sulfur	5 ppm by volume	
Smelt Dissolving Tank		0.025 g/kg air-dried pulp (0.0125) lb/ton air-dried pulp	
Cross Recovery Furnace	Total reduced sulfur	25 ppm on dry basis corrected to 8% oxygen	
Smelt Dissolving Tank		.0084 g/kg black liquor solids (0.0168 lb/ton)	
Lime kiln		8 ppm corrected to 10% oxygen	
Subpart DD--Grain Elevators	Particulate	0.023 g/dscm (0.01 gr/dscf)	0%
Column Dryer, Rack Dryer			5%
Truck Unloading Station, Rail Car Unloading Station			0%
Grain Handling Operation			10%
Truck Loading Station			20%
Barge or Ship Loading Station	Air ventilation	32.1 m^3 air/m^3 grain handling capacity	
Subpart HH--Lime Manufacturing Plants Rotary Lime Kiln	Particulate	0.15 kg/mg limestone feed (0.30 lb/ton)	10%
Lime Hydrator		0.075 kg/mg lime feed (0.15 lb/ton)	

TABLE 19. PROPOSED NEW SOURCE PERFORMANCE STANDARDS

New Stationary Source Performance Standards	Pollutant	No Discharge in Excess of Regulations	Opacity
Subpart D--Fossil Fuel Fired Steam Generators generating more than 73 MW (250 M Btu)	Particulate	13 ng/Joule heat input (0.030 lb/mBtu) derived from fossil fuel	20%
	Sulfur Dioxide	520 ng/Joule heat input (1.20 lb/M Btu) from solid fossil fuel and 85% reduction of uncontrolled SO$_2$ emissions if SO$_2$ emissions >86 ng/J (0.20 lb/M Btu)(0.80 lb/M Btu) from liquid or gaseous fossil fuel and 85% reduction of uncontrolled SO$_2$ emissions if SO$_2$ emissions > 86ng/J (0.20 lb/M Btu)	
	Nitrogen Oxides	210 ng/J (0.50 lb/M Btu) heat input derived from subbituminous coal, shale oil, or any solid, liquid or gaseous fuel derived from coal 260 ng/J (0.60 lb/M Btu) heat input derived from bituminous coal	
Subpart S--Primary Aluminum Plants	Fluorides		
Soderberg Plants		1.25 kg/metric ton (2.5 lb/ton) of aluminum	
Potroom groups at Prebake Plants		1.25 kg/metric ton (2.5 lb/ton) of aluminum	

TABLE 20. PROPOSED PRIORITY LIST OF SOURCE CATEGORIES TO BE SUBJECT TO NSPS OR NESHAP COVERAGE

1. Synthetic organic chemical manufacturing
2. Carbon black
3. Industrial surface coating: Cans
4. Petroleum refinery: Fugitive sources
5. Industrial surface coating: Paper
6. Dry cleaning
7. Fuel conversion
8. Industrial surface coating: Fabric
9. Graphic arts
10. By-product coke ovens
11. Incineration: Industrial-commercial
12. Polymers and resins: Acrylic resins
13. Mineral wool
14. Stationary internal combustion engines
15. Industrial surface coating: Automobiles
16. Fossil-fuel-fired steam generators: Industrial boilers
17. Explosives
18. Non-metallic mineral processing
19. Metallic mineral processing
20. Secondary copper
21. Phosphate rock preparation
22. Chemical wood pulping: Neutral sulfite (NSSC)
23. Foundries: Grey iron
24. Chemical wood pulping: Acid sulfite
25. Crude oil and natural gas production
26.
27. Vegetable oil
28. Synthetic rubber
29. Varnish
30. Polymers and resins: Polyethylene
31. Charcoal
32. Industrial surface coating: Metal coil
33. Transportation and marketing
34. Printing ink
35 Synthetic fibers
36. Plywood manufacture
37. Industrial surface coating: Large appliances
38. Glass
39.
40. Potash
41. Foundries: Steel
42. Secondary aluminum
43. Sintering: Clay and flyash
44. Ammonium sulfate
45. Gypsum
46. Sodium carbonate
47. Hydrofluoric acid
48. Fiberglass
49. Brick and related clay products
50. Polymers and resins: Phenolic resins
51. Polymers and resins: Urea-melamine resins
52. Ammonia
53. Polymers and resins: Polystyrene
54. Polymers and resins: ABS-SAN resins
55. Polymers and resins: Polypropylene
56. Textile processing
57. Asphalt roofing
58. Ceramic clay
59. Ammonium nitrate fertilizer
60. Castable refractories
61. Borax and boric acid
62. Polymers and resins: Polyester resins
63. Starch
64. Perlite
65. Phosphoric acid: Thermal process
66. Secondary zinc
67. Uranium refining
68. Alfalfa dehydrating
69. Animal feed defluorination
70. Urea (for fertilizer and polymers)
71. Detergent
72. Gasoline additives

[a]Lead acid battery manufacture.
[a]Solvent metal cleaning (degreasing).
[a]Industrial surface coating: metal furniture.

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[a]Not prioritized but included on list.

Note: Priorities 26 and 39 were not designated in the list.

TABLE 21. ORGANIC CHEMICALS INDUSTRY PROCESSES CONSIDERED LIKELY CANDIDATES FOR NSPS OR NESHAPs COVERAGE

Acetic anhydride plants
Acetone plants
Acetic acid plants
Acrylic acid plants
Acrylonitrile plants
Adipic acid plants
Allyl chloride plants
Carbon tetrachloride plants
Cyclohexane plants
Cyclohexanol/cyclohexanone plants
Dimethyl terephthalate plants
Ethylbenzene plants
Ethylene dichloride plants
Ethylene glycol plants
Ethylene oxide plants
Ethylene plants
Formaldehyde plants
Maleic anhydride plants
Methanol plants
Methyl chloroform plants
Methyl methacrylate plants
Phenol plants
Phthalic anhydride (PAN) plants
Propylene oxide plants
Styrene plants
Terephthalic acid plants
Vinyl acetate plants

TABLE 22. NATIONAL EMISSION STANDARDS FOR HAZARDOUS AIR POLLUTANTS (NESHAP)

Source	Standard
SUBPART B ASBESTOS	
Asbestos Mills	No visible emissions.
Roadways	Surfacing with asbestos tailings with asbestos-containing wastes is prohibited
Fabricating or manufacturing (specific operations using commercial asbestos)	No visible emission
Demolition and renovation (structures containing >80 m of pipe insulated with friable asbestos or >15 m^2 of other friable asbestos insulation material)	Prior written notice to Administrator of intention to demolish or renovate is required. Asbestos material should be removed before demolishing
Spraying (material containing >1 percent asbestos dry weight basis)	Report of intention required. No visible emission. Spray-on materials used to insulate or fireproof buildings, structures, pipes, and conduits shall contain <1 percent asbestos.
Treatment of asbestos containing waste material with water	No visible emission
SUBPART C BERYLLIUM	
Emissions from stationary sources	10 grams/24 hr or concentration limit in vicinity not to exceed 0.01 $\mu g/m^3$ averaged over 30 days
SUBPART D BERYLLIUM ROCKET MOTOR FIRING	
Atmospheric concentrations at rocket motor test sites	75 $\mu g \cdot minutes/m^3$ of air within 10 to 60 minutes, accumulated during two consecutive weeks.
Emissions from tank collecting combustion products from firing of beryllium propellant	2 g/hr and maximum 10 g/day
SUBPART E MERCURY	
Emissions from mercury ore processing facilities and mercury cell chlor-alkali plants	2300 g/24 hrs
Emissions from sludge incineration plants, sludge drying plants or combinations that process wastewater treatment plant sludges	3200 g/24 hrs
SUBPART F VINYL CHLORIDE	
Ethylene Dichloride Plants	
All exhaust gases	10 ppm *(Proposed: 5 ppm)*
Each oxychlorination reactor	0.2 g/kg of the 100 percent ethylene dichloride product.
Relief valves	No discharge
Fugitive emissions	Minimized
Vinyl Chloride Plants	
Formation and purification exhaust gases	10 ppm *(Proposed: 5 ppm)*
Relief valves	No discharge
Fugitive emissions	Minimized
Polyvinyl Chloride Plants	
Exhaust gases from reactor or stripper or mixing, weighing, or holding containers, or monomer recovery system	10 ppm *(Proposed: 5 ppm)*
Opening loss from reactor	0.02 g vinyl chloride per kg of polyvinyl chloride product
Manual vent valve discharge	No discharge.
Relief valves.	No discharge
Fugitive emissions	Minimized

[a] 40 CFR, Part 60.

TABLE 23. PREVENTION OF SIGNIFICANT DETERIORATION (PSD) CLEAN AIR REGION CLASSIFICATION CRITERIA

Class	Criteria
Class I	A. The following areas are automatically classified as Class I if they were in existence at the time of enactment of the Clean Air Act Amendments of 1977 (August 7, 1977). They may not be redesignated. . International parks . National wilderness areas >5,000 acres . National memorial parks >5,000 acres . National parks >6,000 acres.
	B. All areas which were redesignated as Class I under regulations promulgated before enactment of the amendments may be redesignated.
Class II	A. All areas except those automatically designated as Class I or petitioned to Class III are Class II areas.
	B. The following areas may remain Class II or may be redesignated as Class I only. . National monument >10,000 acres . National primitive area >10,000 acres . National preserve >10,000 acres . National recreation area >10,000 acres . National wild and scenic river >10,000 acres . National wildlife refuge >10,000 acres . National lakeshore or seashore >10,000 acres . National park or wilderness area >10,000 acres established after enactment of amendments (August 7, 1977).
	C. Indian reservations may be designated only by the appropriate Indian governing body.
Class III	Designation as a Class III area is achieved by petition and public hearing and requires approval from the Governor of the State, consultation with the legislature and local governments representing the affected residents. A Class III redesignation must not contribute to concentrations of a pollutant which exceed the maximum allowable increase in another area.

TABLE 24. PREVENTION OF SIGNIFICANT DETERIORATION PERMITTED INCREMENTS (Allowed increase over baseline concentration in $\mu g/m^3$)

		Class I	Class II	Class III	NAAQS
SO_2	Annual	2	20	40	80
	24-hour[a]	8	91	182	365
	3-hour[a]	25	512	700	1,300 (S)[c]
TSP[b]	Annual	5	19	37	7,560 (S)[c]
	24-hour[a]	10	37	75	260,150 (S)[c]

[a] All 24-hour and 3-hour values may be exceeded once per year.

[b] TSP is total suspended particulate.

[c] (S) indicates secondary standard.

TABLE 25. ADDITIONAL ALLOWANCES FOR CLASS I (SO_2 increment limits for 18 exceeding days/yr)

Time	High Terrain (900 ft above stack base)	Low Terrain
24 hour maximum	62 $\mu g/m^3$	36 $\mu g/m^3$
3 hour maximum	221 $\mu g/m^3$	130 $\mu g/m^3$

TABLE 26. MAJOR STATIONARY SOURCES SUBJECT TO PSD REVIEW

Carbon Black Plants
(furnace process)
Charcoal Production Facilities
Coal Cleaning Plants
Chemical Process Plants
Coke Oven Batteries
Fossil-Fuel Boilers
(>250 million Btu/h)
Fuel Conversion Plants
Glass Fiber Processing Plants
Hydrofluoric Acid Plants
Iron and Steel Mill Plants
Kraft Pulp Mills
Lime Plants
Municipal Incinerators
(>250 tons/day)
Petroleum Refineries
Petroleum Storage and Transfer Facilities
(>300,000 bbls)
Phosphate Rock Processing Plants
Portland Cement Plants
Power Plants
Power Plants
(>250 million Btu/h)
Primary Aluminum Ore Reduction Plants
Primary Copper Smelters
Primary Lead Smelters
Primary Zinc Smelters
Secondary Metal Production Facilities
Sintering Plants
Specific Sources
(>100 tons/y any pollutant)
Sulfur Recovery Plants
Sulfuric Acid Plants
Taconite Ore Processing Facilities
Any other source
(>250 tons/yr any pollutant)

4.0 FEDERAL WATER POLLUTION CONTROL ACT

In 1948, the original Federal Water Pollution Control Act (FWPCA) was passed. This act and its various amendments are often referred to as the Clean Water Act (CWA). It provided loans for treatment plant construction and temporary authority for the Federal control of interstate water pollution. The enforcement powers were so heavily dependent on the States as to make the act almost unworkable. In 1956, several amendments to the FWPCA were passed which made the Federal enforcement procedures less cumbersome. According to these provisions, a conference among the interested parties would be held. (If the conference did not result in action within six months, a public hearing would be held). If after an additional six-month waiting period neither of these procedures resulted in action, the matter could be taken to court with the consent of the State. The provision for State consent was removed by amendments passed in 1961. The 1961 amendments also extended Federal authority to include all navigable waters in the United States.

In 1965 the Water Quality Act established a new trend in water pollution control. It provided that the States set water quality standards in accordance with Federal guidelines. If the States failed to do so, the standards would be set by HEW subject to a review hearing. In 1966, the Clean Water Restoration Act transferred the Federal Water Pollution Control Administration from the Department of HEW to the Department of the Interior. It also gave the Interior Department the responsibility for the Oil Pollution Act.

After the creation of EPA in 1970, the present system of water pollution control was formulated. The EPA was given the responsibility previously held by the Department of the Interior with respect to water pollution control. In subsequent amendments to the FWPCA in 1973, 1974, 1975, 1976, and 1977, additional Federal programs were established. The goals of these programs were to make waterways of the United States fishable and swimmable by 1983 and to achieve zero discharge of pollutants

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by 1985. The National Pollutant Discharge System was established as the basic regulatory mechanism for water pollution control. Under this program, the States were given the authority to issue permits to "point-source" dischargers provided the dischargers assured that the following standards would be met:

1. Source specific effluent limitations (including New Source Performance Standards).
2. Toxic pollutant regulations (for specific substances regardless of source).
3. Regulations applicable to oil and hazardous substance liability.

The specific regulatory programs are discussed in Sections 4.1, 4.2, 4.3, 4.4, 4.5, and 4.6.

4.1 WATER QUALITY TO BE ACHIEVED BY 1983

In order to achieve the stated water quality goal of fishable and swimmable waters by 1983, each State has been required by EPA to adopt water quality standards that meet or exceed the Federal water quality criteria. The EPA 1976 Quality Criteria for Water (EPA-440/9-76-023) are presented in Table 27. After each State submitted its own water quality standards, which were subsequently approved by EPA, the Federal criteria were removed from the Code of Federal Regulations.

The State water quality standards are used as basis for establishing both point-source based effluent limitations and toxic pollutant limitations used in issuing NPDES permits to point-source discharges.

4.2 CONSENT DECREE SETTLEMENT AGREEMENT

On June 7, 1976, a settlement agreement was reached in response to four suits brought against EPA by various environmental groups. These suits (Natural Resources Defense Council, Inc., _et al._ versus Russell E. Train, CA No. 2153-73; Environmental Defense Fund, _et al._ versus Russell E. Train, CA No. 75-0172; Citizens for a Better Environment, _et al_. versus Russell E. Train, CA No. 75-1698; Natural Resources Defense Council, Inc., _et al._ versus James I. Agee, _et al._, CA No. 75-1267) were filed under the Federal Water Pollution Control Act to force EPA to promulgate regulations to assure meeting of water quality criteria.

According to the "Consent Decree" document, EPA agreed to develop and promulgate effluent guideline limitations for 65 compounds or types of compounds. These compounds are enumerated in Table 28. The EPA is expected to propose criteria to be used in setting effluent limitations for all of these substances

Another provision of the Consent Decree was that 21 industries should be addressed by these effluent limitations and pretreatment standards. These industries are listed in Table 29. The effluent standards developed for these sources should reflect the best available technology economically achievable (BATEA). All of these effluent limitation regulations are due to be promulgated by December 31, 1979. (The settlement agreement also required EPA to set pretreatment standards for this same group of industries to assure the protection of Publically Owned Treatment Works (POTW). At this time pretreatment standards have been promulgated or proposed for eight categories of point sources. It is not known at this time if pretreatment standards will be required for all of the remaining sources.

In anticipation of the issuance of the new effluent guidelines required by the Consent Decree, all NPDES permits being issued are due to expire with 18 months of the anticipated date for the promulgation of the new BATEA regulations required by the Consent Decree. If a State wishes to issue a longer permit, the permit must contain a clause that automatically requires compliance with the new regulations within the scheduled time period.

4.3 SOURCE BASED EFFLUENT LIMITATIONS

Under the FWPCA, EPA is responsible for establishing point-source effluent limitations for municipal dischargers, industrial dischargers, industrial users of municipal treatment works, and effluent limitations for toxic substances (applicable to all dischargers).

Standards promulgated or proposed by EPA at 40 CFR, Parts 402 through 699, prescribe effluent limitation guidelines for existing sources, standards of performance for new sources, and pretreatment standards for new and existing sources. Effluent limitations and New Source Performance Standards apply to discharges made directly into receiving bodies of water. The new standards are to be used by the States when issuing NPDES permits for all sources 18 months after they are made final by EPA. Table 30 presents a list of industries for which BAT Guidelines will be issued and the date on which they must be used in setting effluent limitations in State NPDES permits. Pretreatment standards apply to waste streams from these same sources that are sent to POTW for final treatment. These regulations are meant to protect the POTW from any materials that would either harm the treatment facility or pass through untreated. They are to be enforced primarily by the local POTW. These standards are applicable to particular classes of point-sources and pertain to discharges into navigable waters without regard to the quality of the receiving water. Standards are specific for numerous subcategories under each point-source category. Effluent and pretreatment standards that reflect the more stringent guidelines are presented in Tables 31 and 32, respectively. A listing of the pollutants and water quality characteristics addressed by effluent limitations is given in Table 33.

Limitations based upon application of the best practicable control technology currently available (BPT) apply to existing point-sources and should have been achieved by July 1, 1977. Limitations based upon application of the BATEA which will result in reasonable further progress toward elimination of discharge must be achieved by July 1, 1984. New Source Performance Standards (NSPS) apply to sources for which construction is commenced after publication of proposed regulations prescribing standards of performance for new sources within a point-source category.

4.4 BEST CONVENTIONAL POLLUTANT CONTROL TECHNOLOGY (BCT)

On August 23, 1978 (43 FR 37570), the EPA proposed a new approach to the control of conventional pollutants by effluent guidelines limitation. The new guidelines would be known as Best Conventional Pollutant Control Technology (BCT). These guidelines would replace the existing BAT limitations which are determined to be unreasonable for conventional pollutants. Currently EPA proposes to withdraw the unreasonable BAT limits and leave the BPT limits in effect until new BCT limitations are developed. The BAT limitations for unconventional and toxic pollutants would remain in effect. Currently, biological oxygen demanding pollutants (BOD_5), total suspended solids (TSS), fecal coliform, and pH are considered conventional pollutants. EPA also proposes to include chemical oxygen demanding (COD) pollutants, oil and grease, and total phosphorus on this list. BCT also requires that the limitations set consider the cost in relation to the effluent reductions achieved.

The 1977 Clean Water Act directs EPA to review all BAT guidelines for conventional pollutants in those industries not covered by the Consent Decree Settlement Agreement. If BPT and BAT do not allow a discharge of process wastewater or if BAT and BPT limitations are identical, no further study is made because BCT regulations would be unnecessary. A list of these categories is found in Table 34.

The remaining industrial sources of process wastewater have been reviewed with respect to the reduction of BOD_5, TSS, COD, oil and grease and total phosphorus. Since BAT and BPT limitations for fecal coliform and pH are always identical a review of these pollutants were not made. In order to determine if BCT limitations would be necessary the cost effectiveness of conventional pollutant reduction to BAT levels beyond BPT levels must be determined and compared to the cost of removal of this same amount of pollutant by a Publicly Owned Treatment Works of similar capacity. If it is equally cost-effective for the industry to achieve the reduction required for meeting the BAT limitations as the POTW then the BCT limit is made equal to the BAT levels and no further studies are necessary. The industries for which this is true are listed in Table 35.

When this test is applied, the BAT limitation set for six categories were found to be unreasonable. These categories and subcategories are listed in Table 36. In these subcategories EPA proposes to remove the BAT limitations and revert to the BPT limitations until BCT control levels can be formulated. There will be no variance granted to compliance to the BCT limits once they are set. These limits are required to meet the cost-effectiveness conditions outlined above and be at least as stringent as BPT levels.

4.5 TOXIC POLLUTANT EFFLUENT STANDARDS

Under Section 307a of the FWPCA, EPA is required to publish a list of designated toxic pollutants and is authorized to promulgate effluent standards for those pollutants. Such effluent standards should take into account the toxicity of the pollutant, its persistence, degradability, the usual or potential presence of affected organisms in any waters, the importance of the affected organisms, the nature and extent of the effect of the toxic pollutant on such organisms, and the extent to which effective control is being or may be achieved under other regulatory authority. Effluent standards promulgated under this section should provide "an ample margin of safety." Source categories to which such standards apply are also specified.

Compounds initially designated toxic pollutants under Section 307a are presented in Table 37. In addition to these compounds, the Clean Water Act of 1977 requires that the "Consent Decree Pollutants" (listed in Table 21) be added to the list of toxic pollutants if effluent limits fail to achieve water quality criteria.

Efforts to promulgate standards under this section of the FWPCA have been underway since 1973, but due to procedural and legal difficulties, only nine chemicals have been regulated to date as toxic pollutants. These regulations from 40 CFR, Part 129, are presented in Table 38. EPA expects to propose criteria for 20 additional toxic pollutants by the end of 1978. The remaining pollutants from the Consent Decree list are due to have proposed criteria by early 1979.

4.6 OIL AND HAZARDOUS LIABILITY

The FWPCA under Section 311 entitled "Oil and Hazardous Substance Liability," authorizes EPA to promulgate Hazardous Spill Regulations. Under these regulations EPA designated as hazardous those substances which, when discharged, present an imminent and substantial danger to the public health or welfare. Harmful quantities for each substance designated as hazardous were specified and rates of penalty for discharging designated hazardous substances were also established under this section. In 1978 a list of 271 hazardous substances along with determined harmful quantities discharged in a 24-hour period and penalties for such discharge were adopted by EPA. These regulations found in 40 CFR, Parts 116, 118, and 119, are presented in Table 39. The regulations require that any owner or operator of a point-source discharging hazardous substances in quantities exceeding those specified in the regulations must pay penalties in accordance with the rates of penalty established in the regulations. Sources in compliance with effluent standards established in other sections of the Clean Water Act are exempt from these requirements.

In addition to the substances listed in Table 39, an additional list of 28 pollutants have been proposed by EPA to be designated as hazardous under Section 311 of FWPCA. These compounds are listed in Table 40.

On October 6, 1978, Judge Earl E. Vernon of the Western District of Louisiana ruled that these regulations were arbitrary, capricious, and contrary to law and therefore overturned this whole body of regulations. In response to this action, Congress immediately passed an amendment to the Clean Water Act which deleted the removability and harmful quantity segments of the Hazardous Spill Regulations. Under the new provisions, EPA must seek to impose penalties on a case-by-case basis through the court.

TABLE 27. EPA 1976 QUALITY CRITERIA FOR WATER

Water Quality Characteristic or Pollutant	Criteria
Aesthetic Qualities	All waters free from substances attributable to wastewater or other discharges that: (1) settle to form objectionable deposits; (2) float as debris, scum, oil, or other matter to form nuisances; (3) produce objectionable color, odor, taste, or turbidity; (4) injure or are toxic or produce adverse physiological responses in humans, animals, or plants; and, (5) produce undesirable or nuisance aquatic life.
Alkalinity	20 mg/ℓ or more as $CaCO_3$ for freshwater aquatic life except where natural concentrations are less.
Ammonia	0.02 mg/ℓ (as un-ionized ammonia) for freshwater aquatic life.
Arsenic	50 µg/ℓ for domestic water supplies (health); 100 µg/ℓ for irrigation of crops.
Barium	1 mg/ℓ for domestic water supply (health).
Beryllium	11 µg/ℓ for the protection of aquatic life in soft fresh water; 1,100 µg/ℓ for the protection of aquatic life in hard fresh water; 100 µg/ℓ for continuous irrigation on all soils; except 500 µg/ℓ for irrigation on neutral to alkaline fine-textured soils.
Boron	750 µg/ℓ for long-term irrigation on sensitive crops.
Cadmium	10 µg/ℓ for domestic water supply (health). Aquatic Life: Fresh Water Soft Water — Hard Water 0.4 µg/ℓ — 1.2 µg/ℓ — for cladocerans and salmonid fishes; 4.0 µg/ℓ — 12.0 µg/ℓ — for other, less sensitive, aquatic life. Marine 5.0 µg/ℓ
Chlorine	Total residual chlorine: 2.0 µg/ℓ for salmonid fish; 10.0 µg/ℓ for other freshwater and marine organisms.
Chromium	50 µg/ℓ for domestic water supply (health); 100 µg/ℓ for freshwater aquatic life.
Fecal Coliform Bacteria	Bathing Waters: Based on a minimum of not less than five samples taken over a 30-day period, the fecal coliform bacterial level should not exceed a log mean of 200 per 100 mℓ nor should more than 10 percent of the total samples taken during any 30-day period exceed 400 per 100 mℓ. Shellfish Harvesting Waters: Not to exceed a median fecal coliform bacterial concentration of 14 per 100 mℓ with not more than 10 percent of samples exceeding 43 per 100 mℓ for the taking of shellfish.
Color	Waters shall be virtually free from substances producing objectionable color for aesthetic purposes; The source of supply should not exceed 75 color units on the platinum-cobalt scale for domestic water supplies; and Increased color (in combination with turbidity) should not reduce the depth of the compensation point for photosynthetic activity by more than 10 percent from the seasonally established norm for aquatic life.
Copper	1.0 mg/ℓ for domestic water supplies (welfare). For freshwater and marine aquatic life, 0.1 times a 96-hour LC50 as determined through nonaerated bioassay using a sensitive aquatic resident species.
Cyanide	5.0 µg/ℓ for freshwater and marine aquatic life and wildlife.

TABLE 27. (continued)

Gases. Total Dissolved	To protect freshwater and marine aquatic life, the total dissolved gas concentrations in water should not exceed 110 percent of the saturation value for gases at the existing atmospheric and hydrostatic pressures.
Iron	0.3 mg/ℓ for domestic water supplies (welfare). 1.0 mg/ℓ for freshwater aquatic life.
Lead	50 μg/ℓ for domestic water supply (health). 0.01 times the 96-hour LC_{50} value, using the receiving or comparable water as the diluent and soluble lead measurements (nonfilterable lead using an 0.45 micron filter), for sensitive freshwater resident species.
Manganese	50 μg/ℓ for domestic water supplies (welfare); 100 μg/ℓ for protection of consumers of marine mollusks.
Mercury	2.0 μg/ℓ for domestic water supply (health); 0.05 μg/ℓ for freshwater aquatic life and wildlife; 0.10 μg/ℓ for marine aquatic life.
Nickel	0.01 of the 96-hour LC_{50} for freshwater and marine aquatic life.
Nitrates, Nitrites	10 mg/ℓ nitrate nitrogen (N) for domestic water supply (health).
Oil and Grease	For domestic water supply: Virtually free from oil and grease, particularly from the tastes and odors that emanate from petroleum products. For aquatic life: 0.01 of the lowest continuous flow 96-hour LC_{50} to several important freshwater and marine species, each having a demonstrated high susceptibility to oils and petrochemicals. Levels of oils or petrochemicals in the sediment which cause deleterious effects to the biota should not be allowed. Surface waters shall be virtually free from floating nonpetroleum oils of vegetable or animal origin, as well as petroleum derived oils.
Dissolved Oxygen	Aesthetics: Water should contain sufficient dissolved oxygen to maintain aerobic conditions in the water column and, except as affected by natural phenomena, at the sediment-water interface. Freshwater aquatic life: A minimum concentration of dissolved oxygen to maintain good fish populations is 5.0 mg/ℓ. The criterion for salmonid spawning beds is a minimum of 5.0 mg/ℓ in the interstitial water of the gravel.
Aldrin-Dieldrin	0.003 μg/ℓ for freshwater and marine aquatic life. The persistence, bioaccumulation potential and carcinogenicity of aldrin-dieldrin cautions human exposure to a minimum.
Chlordane	0.01 μg/ℓ for freshwater aquatic life. 0.004 μg/ℓ for marine aquatic life. The persistence, bioaccumulation potential and carcinogenicity of chlordane cautions human exposure to a minimum.
Chlorophenoxy Herbicides	2, 4-D; 100 μg/ℓ for domestic water supply (health) 2, 4, 5-TP: 10 μg/ℓ for domestic water supply (health)
DDT	0.001 μg/ℓ for freshwater and marine aquatic life. The persistence, bioaccumulation potential, and carcinogenicity of DDT cautions human exposure to a minimum.
Dementon	0.1 μg/ℓ for freshwater and marine aquatic life.
Endosulfan	0.003 μg/ℓ for freshwater aquatic life; 0.001 μg/ℓ for marine aquatic life.
Endrin	0.2 μg/ℓ for domestic water supply (health); 0.004 μg/ℓ for freshwater and marine aquatic life.
Guthion	0.01 μg/ℓ for freshwater and marine aquatic life.
Heptachlor	0.001 μg/ℓ for freshwater and marine aquatic life. The persistence, bioaccumulation potential and carcinogenicity of heptachlor cautions human exposure to a minimum.

TABLE 27. (continued)

Lindane	4.0 µg/ℓ for domestic water supply (health); 0.01 µg/ℓ for freshwater aquatic life; 0.004 µg/ℓ for marine aquatic life.
Malathion	0.1 µg/ℓ for freshwater and marine aquatic life.
Methoxychlor	100 µg/ℓ for domestic water supply (health); 0.03 µg/ℓ for freshwater and marine aquatic life.
Mirex	0.001 µg/ℓ for freshwater and marine aquatic life.
Parathion	0.04 µg/ℓ for freshwater and marine aquatic life.
Toxaphene	5 µg/ℓ for domestic water supply (health); 0.005 µg/ℓ for freshwater and marine aquatic life.
pH	Range: 5-9 Domestic water supplies (welfare); 6.5-9.0 Freshwater aquatic life; 6.5-8.5 Marine aquatic life. (... but not more than 0.2 units outside of normally occurring range)
Phenol	1 µg/ℓ for domestic water supply (welfare), and to protect against fish flesh tainting.
Phosphorus	0.10 µg/ℓ yellow (elemental) phosphorus for marine or estuarine waters.
Phthalate Esters	3 µg/ℓ for freshwater aquatic life.
Polychlorinated Biphenyls	0.001 µg/ℓ for freshwater and marine aquatic life and for consumers thereof. Every reasonable effort should be made to minimize human exposure.
Selenium	10 µg/ℓ for domestic water supply (health); For marine and freshwater aquatic life; 0.01 of the 96-hour LC_{50} as determined through bioassay using a sensitive resident species
Silver	50 µg/ℓ for domestic water supply (health). For marine and freshwater aquatic life; 0.01 of the 96-hour LC_{50} as determined through bioassay using a sensitive resident species
Solids (Dissolved) and Salinity	250 mg/ℓ for chlorides and sulfates in domestic water supplies (welfare).
Solids (Suspended, Settleable) and Turbidity	Freshwater fish and other aquatic life: Settleable and suspended solids should not reduce the depth of the compensation point for photosynthetic activity by more then 10 percent from the seasonably established norm for aquatic life.
Sulfide - Hydrogen Sulfide	2 µg/ℓ undissociated H_2S for fish and other aquatic life, fresh and marine water.
Tainting Substances	Materials should not be present in concentrations that individually or in combination produce undesirable flavors which are detectable by organoleptic tests performed on the edible portions of aquatic organisms.
Temperature	Freshwater Aquatic Life: For any time of year, there are two upper limiting temperatures for a location (based on the important sensitive species found there at that time): (1) One limit consists of a maximum temperature for short exposures that is time dependent and is given by the species-specific equation: $\text{Temperature}_{(C^\circ)} = {}^{1}/_{b}\ (\log_{10}\ \text{time}_{(min)}\ -a)\ -2^\circ C$ where: $\log_{10}$ = logarithm to base 10 (common logarithm) a = intercept on the "y" or logarithmic axis of the line fitted to experimental data and which is available from Appendix II-C, NAS, 1974 for some species. b = slope of the line fitted to experimental data and available from Appendix II-C, NAS, 1974 for some species. and (2) The second value is a limit on the weekly average temperature that:

TABLE 27. (continued)

Temperature (continued)	a. In the cooler months (mid-October to mid-April in the north and December to February in the south) will protect against mortality of important species if the elevated plume temperature is suddenly dropped to the ambient temperature, with the limit the acclimation temperature -2°C when the lower lethal threshold temperature equals the ambient water temperature (in some regions this limitation may also be applicable in summer); or b. In the warmer months (April through October in the north and March through November in the south) is determined by adding to the physiological optimum temperature (usually for growth) a factor calculated as one-third of the difference between the ultimate upper incipient lethal temperature and the optimum temperature for the most sensitive important species (and appropriate life state) that normally is found at that location and time. c. During reproductive seasons (generally April through June and September through October in the north and March through May and October through November in the south) the limit is that temperature that meets site-specific requirements for successful migration, spawning. egg incubation, fry rearing, and other reproductive functions of important species. These local requirements should supersede all other requirements when they are applicable. d. There is a site-specific limit that is found necessary to preserve normal species diversity or prevent appearance of nuisance organisms.

TABLE 28. TOXIC POLLUTANTS SPECIFIED IN THE NRDC-EPA SETTLEMENT AGREEMENT (CONSENT DECREE COMPOUNDS)

Acenaphthene

Acrolein

Acrylonitrile

Aldrin/Dieldrin

Antimony and compounds[a]

Arsenic and compounds

Asbestos

Benzene

Benzidine

Beryllium and compounds

Cadmium and compounds

Carbon tetrachloride

Chlordane (technical mixture and metabolites)

Chlorinated benzenes (other than dichlorobenzenes)

Chlorinated ethanes (including 1,2-dichloroethane, 1,1,1-trichloroethane, and hexachloroethane)

Chloroalkyl ethers (chloromethyl, chloroethyl, and mixed ethers)

Chlorinated naphthalene

Chlorinated phenols (other than those listed elsewhere; includes trichlorphenols and chlorinated cresols)

Chloroform

2-Chlorophenol

Chromium and compounds

Copper and compounds

Cyanides

DDT and metabolites

Dichlorobenzenes (1,2-,1,3-, and 1,4-dichlorobenzenes)

Dichlorobenzidine

Dichloroethylenes (1,1- and 1,2-dichloroethylene)

2,4-Dichlorophenol

Dichloropropane and dichloropropene

2,4-Dimethylphenol

Dinitrotoluene

Diphenylhydrazine

Endosulfan and metabolites

Endrin and metabolites

Ethylbenzene

Fluoranthene

Haloethers (other than those listed elsewhere: includes chlorophenylphenyl ethers, bromophenylphenyl ether, bis(dichloroisopropyl) ether, bis-(chloroethoxy) methane and polychlorinated diphenyl ethers)

Halomethanes (other than those listed elsewhere; includes methylene chloride, methylchloride, methylbromide, bromoform, dichlorobromomethane, trichlorofluoromethane, dichlorodifluoromethane)

Heptachlor and metabolites

Hexachlorobutadiene

Hexachlorocyclohexane (all isomers)

Hexachlorocyclopentadiene

Isophorone

Lead and compounds

Mercury and compounds

Naphthalene

Nickel and compounds

Nitrobenzene

Nitrophenols (including 2,4-dinitrophenol, dinitrocresol)

Nitrosamines

Pentachlorophenol

Phenol

Phthalate esters

Polychlorinated biphenyls (PCBs)

Polynuclear aromatic hydrocarbons (including benzanthracenes, benzopyrenes, benzofluoranthene, chrysenes, dibenzanthracenes, and indenopyrenes)

Selenium and compounds

Silver and compounds

2,3,7,8-Tetrachlorodibenzo-p-dioxin (TCDD)

Tetrachloroethylene

Thallium and compounds

Toluene

Toxaphene

Trichloroethylene

Vinyl chloride

Zinc compounds

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[a] As used throughout this table, the term "compounds" shall include organic and inorganic compounds.

TABLE 29. POINT SOURCE CATEGORIES TO BE ADDRESSED IN ACCORDANCE WITH THE NRDC VS. EPA SETTLEMENT AGREEMENT

1. Timber products processing
2. Steam electric power plants
3. Leather tanning and finishing
4. Iron and steel manufacturing
5. Petroleum refining
6. Inorganic chemicals manufacturing
7. Textile mills
8. Organic chemicals manufacturing
9. Nonferrous metals manufacturing
10. Paving and roofing materials (Tars and asphalt)
11. Paint and ink formulation and printing
12. Soap and detergent manufacturing
13. Auto and other laundries
14. Plastic and synthetic materials manufacturing
15. Pulp and paperboard mills, and converted paper products
16. Rubber processing
17. Miscellaneous chemicals
18. Machinery and mechanical products manufacturing
19. Electroplating
20. Ore mining and dressing
21. Coal mining

TABLE 30. INDUSTRIES FOR WHICH BAT GUIDELINES AND DATA 18 MONTHS AFTER FINAL GUIDELINES

Petroleum Refining	September 30, 1980
Inorganic Chemicals Manufacturing	March 31, 1981
Textile Mills	March 31, 1981
Organic Chemicals Manufacturing	March 31, 1981
Plastic and Synthetic Materials Manufacturing	March 31, 1981
Rubber Processing	March 31, 1981
Paving and Roofing Materials Manufacturing	December 31, 1980
Soap and Detergent Manufacturing	June 30, 1981
Miscellaneous Chemicals Manufacturing	June 30, 1981
Electroplating	June 30, 1981
Paint and Ink Formulating and Printing	December 31, 1981

TABLE 31. SELECTED EPA EFFLUENT STANDARDS

Category	Subcategory	Basis	Pollutant or effluent characteristic	Maximum for any one day	Average of daily values for 30 consecutive days shall not exceed:
Cooling water intake structures (Part 402)	None	BAT	Minimum adverse environmental impact from each location, design, construction, and capacity as contained in the Development Document.		
Dairy products processing (Part 405) [Expressed in kg/kkg of BOD_5 input]	[A through L] A. Receiving stations	BAT, NSPS	BOD_5	0.100	0.050
			TSS	0.126	0.063
			pH	6.0 - 9.0	
Grain mills (Part 406) [Expressed in kg/kkg of wheat, corn, rice, cereal product, raw material]	[A through J] For four subcategories	BPT, BAT, NSPS	No discharge of process wastewater pollutants to navigable waters.		
	B. Bulgar wheat	BAT,NSPS	BOD_5	0.015	0.005
			TSS	0.0099	0.0033
			pH	6.0 - 9.0	
Canned and preserved fruits and vegetables (Part 407)	[A through H] G. Canned and preserved vegetables	BAT, NSPS	BOD_5	0.046	0.038
			TSS	0.087	0.064
			pH	6.0 - 9.0 at all times	
Canned and preserved seafood processing (Part 408) [Expressed in kg/kkg of seafood]	[A through AG] For three subcategories	BAT	No pollutants discharged exceeding 1.27 cm (0.5") in any dimension.		
	B. Conventional blue crab processing	BAT, NSPS	BOD_5	0.30	0.15
			TSS	0.90	0.45
			Oil and grease	0.13	0.065
			pH	6.0 to 9.0	
	R. West Coast hand-butchered salmon processing	BAT	TSS	0.23	0.14
			Oil and grease	0.045	0.018
Sugar processing (Part 409) [Expressed in kg/kkg of product]	[A through H] A. Beet sugar processing	NSPS	No discharge of process wastewater pollutants to navigable waters.		
	B. Crystalline cane sugar refining	BAT, NSPS	BOD_5	0.18	0.09
			TSS	0.11	0.035
			pH	6.0 to 9.0	
Textile industry (Part 410) [Expressed in kg/kkg of product]	[A through G] C. Dry processing	BAT	BOD_5	0.4	0.2
			TSS	0.4	0.2
			COD	0.8	0.4
		BPT, BAT, NSPS	Fecal coliform	400 counts/ 100 mℓ	
			pH	6.0 - 9.0	
	F. Carpet mills	BPT, BAT, NSPS	Total chromium	0.04	0.02
			Phenol	0.04	0.02
			Sulfide	0.08	0.04
			Color	225 ADMI units	

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[a] 40 CFR, Parts 402-460.

TABLE 31. (continued)

Category	Subcategory	Basis	Pollutant or effluent characteristic	Maximum for any one day	Average of daily values for 30 consecutive days shall not exceed:
Cement Manufacturing (Part 411) [Expressed in kg/kkg of product]	[A through C] A. Leaching	BPT, BAT, NSPS	TSS	0.005 (of dust leached)	
	C. Materials Storage Piles Runoff	NSPS	No discharge of process wastewater pollutants to navigable waters.		
			pH	6.0 - 9.0	
			Temperature	3°C rise above inlet temperature	
Feedlots (Part 412) [Expressed in kg/kkg of animal/fowl]	[A and B] For both subcategories.	NSPS	No discharge of process wastewater pollutants to navigable waters.		
Electroplating (Part 413) [Expressed as mg/liter] **Note:** All previous standards have been revoked/suspended.	[A through G] All subcategories-Plants discharging more than 40,000 gals/day of process wastewater	Pretreatment Standards	Cyanide Amenable to Chlorination	0.20	0.08
			Total Cyanide	0.64	0.08
			Hexavalent Chromium	0.25	0.09
			pH	7.5 to	10.0
Organic Chemicals Manufacturing (Part 414) [Expressed in kg/kkg of product]	[B] B. Processes with process water contact as steam diluent or absorbent	BAT, NSPS	COD	7.8	4.2
			BOD_5	0.57	0.27
			TSS	0.94	0.50
			pH	6.0 - 9.0	
Inorganic Chemicals Manufacturing (Part 415) [Expressed in kg/kkg of product] **Note:** For many of the subcategories, standards have been temporarily revoked. Many others are in "reserved" status.	[A through BK] For thirty-three subcategories	NSPS, BAT	No discharge of process wastewater pollutants to navigable waters.		
Plastics and Synthetics Manufacturing (Part 416) **Note:** All standards have been revoked/suspended.	[A through T]				
Soap and Detergent Manufacturing (Part 417)	[A through S] I. Oleum Sulfonation and Sulfation	NSPS	Surfactants	0.03	0.01
	N. Neutralization of Sulfuric Acid Esters & Sulfonic Acids	NSPS	BOD_5	0.02	0.01
			COD	0.08	0.04
			pH	6.0 to	9.0
	P. Manufacture of Liquid Detergents	BAT, NSPS	TSS	0.01	0.005
			Oil and Grease	0.01	0.005

TABLE 31. (continued)

Category	Subcategory	Basis	Pollutant or effluent characteristic	Maximum for any one day	Average of daily values for 30 consecutive days shall not exceed:
Fertilizer Manufacture (Part 418) [Expressed in kg/kkg of product]	[A through G] For two sub-categories	BPT, BAT NSPS	No discharge of process wastewater pollutants to navigable waters.		
	A. Phosphate	BPT, BAT, NSPS	No Phosphorus	105.0	35.0
			Fluoride	75.0	25.0
			TSS	150.0	50.0
	B. Ammonia	BAT	Ammonia	0.005	0.025
			pH	6.0 to	9.0
		NSPS	Ammonia	0.11	0.055
	C. Urea	BAT	Organic Nitrogen (as N)	0.61	0.33
		NSPS	Organic Nitrogen (as N)	0.45	0.24
	D. Ammonium Nitrate	BAT, NSPS	Nitrate (as N)	0.12	0.07
Petroleum Refining (Part 419) For typical lube refining, 19785 m^3 per stream · day throughput. [Expressed in kg/km^3 of feedstock]	[A through E] A. Topping (for discharges other than runoff or ballast)	BAT	BOD_5	2.5	2.0
			TSS	2.4	2.0
			COD	10.0	8.0
			Oil and Grease	0.5	0.4
			Phenolic Compounds	0.012	0.0060
			Ammonia (as N)	0.68	0.51
			Sulfide	0.055	0.035
			Total Chromium	0.124	0.105
Iron and Steel Manufacturing (Part 420) [Expressed in kg/kkg of product]	[A through Z] For three sub-categories.	BPT (3) BAT, NSPS (2)	No discharge of process wastewater pollutants to navigable waters.		
	A. Byproduct Coking	BAT, NSPS	Cyanide Amenable to Chlorination	0.0003	0.0001
			Phenol	0.0006	0.0002
			Ammonia	0.0126	0.0042
			Sulfide	0.0003	0.0001
			pH	6.0 - 9.0	
	G. Basic Oxygen (with wet air pollution control methods)	BAT, NSPS	TSS	0.0156	0.0052
			Fluoride	0.0126	0.0042
	H. Open-Hearth Furnace	BAT	Nitrate	0.0282	0.0094

TABLE 31. (continued)

Category	Subcategory	Basis	Pollutant or effluent characteristic	Maximum for any one day	Average of daily values for 30 consecutive days shall not exceed:
Iron and Steel Manufacturing (Cont.)	K. Vacuum Degassing	BAT, NSPS	TSS	0.0078	0.0026
			Zinc	0.0015	0.0005
			Manganese	0.0015	0.0005
			Lead	0.0015	0.0005
	Q. Pickling-Sulfuric-Acid	BPT	Dissolved Iron	0.00033	0.00011
			Oil and Grease	0.00312	0.00104
	T. Hot Coatings-Galvanizing	BPT	Chromium	0.0225	0.0075
			Hexavalent Chromium	0.00015	0.00005
	U. Hot Coatings-Terne	BPT	Tin	0.0375	0.0125
	X. Scale Removal (Kolene and Hydride)	BPT	Cyanide	0.0015	0.0005
	Y. Wire Pickling and Coating	BPT	Dissolved Copper	0.0030	0.0010
	Z. Continuous Alkaline	BPT	Suspended Solids	0.0156	0.0052
			Dissolved Chromium	0.0003	0.0001
			Dissolved Iron	0.0006	0.0002
			Dissolved Nickel	0.00015	0.00005
Nonferrous Metals Manufacturing (part 421) [Expressed in kg/kkg of product]	[A through H] For six subcategories.	BPT, BAT (6) NSPS (2)	No discharge of process wastewater pollutants to navigable waters.		
	B. Primary Aluminum Smelting	NSPS	Fluoride	0.05	0.025
			TSS	0.1	0.05
	H. Primary Zinc	BAT	TSS	0.28	0.14
			Arsenic	1.1×10^{-8}	5.4×10^{-4}
			Cadmium	5.4×10^{-3}	2.7×10^{-3}
			Selenium	0.054	0.027
			Zinc	0.054	0.027
Phosphate Manufacturing (Part 422) [Expressed in kg/kkg of product]	[A through F] For five subcategories (except for wastewater from a cooling water recirculation system or nonprocess)	BPT, BAT, NSPS	No discharge of process wastewater pollutants to navigable waters.		
	F. Sodium Phosphate	BAT, NSPS	TSS	0.35	0.10
			Total Phosphorus (as P)	0.56	0.28
			Fluorides (as F)	0.21	0.11
			pH	6.0 - 9.0	

TABLE 31. (continued)

Category	Subcategory	Basis	Pollutant or effluent characteristic	Maximum any one day	Average of daily values for 30 consecutive days shall not exceed:
Steam Electric Power Generating (Part 423) [Expressed in mg/ℓ]	[A through D]				
	A. Generating Unit	BPT, BAT, NSPS	pH (all discharges)	6.0 - 9.0	
			Polychlorinated Biphenyl Compounds	No discharge	
			TSS	100.0	30.0
			Oil and Grease	20.0	15.0
			Total Copper from Metal Cleaning or Boiler Blowdown	1.0	1.0
			Total Iron from Metal Cleaning or Boiler Blowdown	1.0	1.0
			Free Available Chlorine from Cooling Tower Blowdown	0.5	0.2
			Materials added for Corrosion Inhibition in Cooling Tower Blowdown	No detectable amount	
		BAT	From Cooling Tower Blowdown		
			Zinc	1.0	1.0
			Chromium	0.2	0.2
			Phosphorus	5.0	5.0
			Heat from Main Condensers		None
Ferroalloy Manufacturing (Part 424) [Expressed in kg/kkg of product]	[A through G]				
	A. Open Electric Furnaces with Wet Air Pollution Control Devices	BAT, NSPS	TSS	0.024	0.012
			Total Chromium	0.0008	0.0004
			Hexavalent Chromium	0.00008	0.00004
			Total Manganese	0.008	0.0039
			pH	6.0	to 9.0
	B. Covered Electric Furnaces and Other Smelting Operations with Wet Air Pollution Control Devices	BAT, NSPS	Total Cyanide	0.0005	0.0003
			Phenols	0.0004	0.0002
Leather Tanning (Part 425) [Expressed in kg/kkg of product]	D. Finishing of Tanned Hides	BAT	BOD_5	1.0	0.5
			TSS	1.2	0.6
			Chrome	0.04	0.02
			Oil and Grease	0.48	0.24
			Sulfide	0.004	0.002
			TKN	0.2	0.1
			Fecal Coliform	400 counts/100 ml maximum at any one time	

TABLE 31. (continued)

Category	Subcategory	Basis	Pollutant or effluent characteristic	Maximum for any one day	Average of daily values for 30 consecutive days shall not exceed:
Glass Manufacturing (Part 426) [Expressed in kg/kkg of product]	[A through M] For four subcategories	BAT, NSPS	No discharge of process wastewater pollutants to navigable waters.		
	E. Float Glass	BAT, NSPS	TSS	0.70	0.70
			Oil	1.40	1.40
			Phosphorus	0.05	0.05
			pH	6.0	to 9.0
Asbestos Manufacturing (Part 427) [Expressed in kg/kkg of product]	[A through K] For four subcategories.	BAT, NSPS	No discharge of process wastewater pollutants to navigable waters.		
	I. Solvent Recovery	BAT, NSPS	COD	0.30	0.15
			TSS	0.18	0.09
			pH	6.0	to 9.0
Rubber Manufacturing (Part 428) [Expressed in kg/kkg of product]	[A through K] A. Tire and Tube Plants	BPT, BAT, NSPS	TSS	0.096	0.064
			Oil and Grease	0.024	0.016
	D. Latex Rubber	BAT	COD	2.66	1.78
			BOD_5	0.11	0.07
			TSS	0.21	0.14
			Oil and Grease	0.11	0.07
			pH	6.0	to 9.0
	I. Medium-Sized General Molded, Extruded, and Fabricated Rubber Plants (lead-sheathed hose production)	BPT, BAT, NSPS	Lead	0.0017	0.0007
	J. Latex-dipped, latex-extruded, and latex-molded rubber	BPT, BAT, NSPS	Chromium	0.0086	0.0036
	K. Latex Foam	BPT, BAT, NSPS	Zinc	0.058	0.024
			BOD_5	2.4	1.4
			TSS	2.26	0.94
Timber Products (Part 429) [Expressed in kg/1000 m^3 of product]	[A through M; Q and R] For twelve subcategories	NSPS BPT (10) BAT (11)	No discharge of process wastewater pollutants to navigable waters.		
	G. Wood Preserving	BAT, NSPS	COD	220.0	110.0
			Phenols	0.21	0.064
			Oil and Grease	6.9	3.4
			pH	6.0	to 9.0
	I. Wet Storage	BPT, BAT, NSPS	Debris	0	0

TABLE 31. (continued)

Category	Subcategory	Basis	Pollutant or effluent characteristic	Maximum for any one day	Average of daily values for 30 consecutive days shall not exceed:
Pulp, Paper and Paperboard (Part 430) [Expressed in kg/kkg of product]	[A through V]				
	D. Unbleached Kraft-Neutral Sulfite Semi-Chemical (cross recovery)	BAT, NSPS	Color	25.0	12.5
	E. Paperboard from Water Paper	BAT	BOD_5	1.3	0.65
			TSS	1.6	0.8
			pH	6.0	to 9.0
	L. Groundwood-Chemi-Mechanical (using zinc hydrosulfite as bleaching agent)	BPT	Zinc	0.034	0.017
Builders Paper and Board Mill (Part 431) [Expressed in kg/kkg of product]	[A]				
	A. Builders Paper and Roofing Felt	BAT, NSPS	BOD_5	1.75	1.0
			TSS	1.75	1.0
			Settleable Solids Not to Exceed 0.2 ml/ℓ		
Meat Products (Part 432) [Expressed in kg/kkg of product]	[A through J]				
	A. Simple Slaughterhouse	BAT	Ammonia	8.0	4.0
			Fecal Coliform	400 mph/100 mℓ	
	F. Meat Cutter [Expressed in kg/kkg of finished product]	BAT	TSS	0.0024	0.0012
		BPT, BAT, NSPS	Oil and Grease	0.012	0.006
		BPT, BAT	pH	6.0	to 9.0
Coal Mining (Part 434) [Expressed in mg/ℓ	[B through D]				
	All subcategories	BPT	Total Iron	7.0	3.5
			TSS	70.0	35.0
			pH	6.0 to 9.0	
Oil and Gas Extraction (Offshore Segment) (Part 435) [Expressed in mg/ℓ]	[A through F]				
	A. Near-Offshore	BPT	Drilling Muds	No discharge of free oil	
			Drill Cuttings	No discharge of free oil	
			Well Treatment	No discharge of free oil	
			Produced Water	72.0	48.0
			Deck Drainings	72.0	48.0
			Produced Sand	No discharge of free oil	
	C. On Shore	BPT	No discharge of wastewater pollutants into navigable waters.		
	E. Beneficial Use	BPT	Produced Water-Oil and Grease	45 mg/ℓ	

TABLE 31. (continued)

Category	Subcategory	Basis	Pollutant or effluent characteristic	Maximum for any one day	Average of daily values for 30 consecutive days shall not exceed:
Mineral Mining and Processing (Part 436) [Expressed in mg/ℓ]	[A through AL] NOTE: For seventeen subcategories, standards are in "reserved" status				
	For sixteen sub-categories	BPT	No discharge of process generated wastewater pollutants to waters.		
	D. Industrial Sand	BPT	Total Fluoride	0.006	0.003
	AL Graphite	BPT	TSS	20	10
			Total Iron	2	1
			pH	6.0 - 9.0	
Pharmaceutical Manufacturing (Part 439) [Expressed in mass unit time]	[A through E] A. Fermentation Products	BPT	BOD_5	Daily average in any calendar month >90% reduction in long-term daily average raw waste content X variability factor of 3.	
			COD	>74% reduction in long-term daily average raw waste content of COD X variability factor of 2.2.	
			pH	6.0 to	9.0
	D. Mixing/Compounding and Formulation	BPT	TSS	52 mg/ℓ	
Ore Mining and Dressing (Part 440) [Expressed in mg/ℓ]	[A through G] B. Base and Precious Metals	BPT	TSS	30.0	20.0
			Copper	0.30	0.15
			Zinc	0.4	0.2
			Lead	0.6	0.3
			Mercury	0.002	0.001
			Cadmium	0.10	0.05
			Cyanide	0.2	0.1
			pH	6.0 to	9.0
	C. Bauxite	BPT	Iron	1.0	0.5
			Aluminum	2.0	1.0
	D. Ferroalloy Ores	BPT	Arsenic	1.0	0.5
	E. Uranium, Radium, and Vanadium Ores	BPT	Uranium	0.40	2.0
			$Radium^{226}$ (dis.)	10.0	3.0
			$Radium^{226}$ (total)	30.0	10.0
			COD	200.0	100.0
			Ammonia	---	100.0
	F. Mercury Ore	BPT	Nickel	0.2	0.1

TABLE 31. (continued)

Category	Subcategory	Basis	Pollutant or effluent characteristic	Maximum for any one day	Average of daily values for 30 consecutive days shall not exceed:
Paving and Roofing Materials (Part 443) [Expressed in kg/kkg of runoff]	[A through D] A. Asphalt Emulsion	BAT, NSPS	Oil and Grease	0.015	0.010
	B. Asphalt Concrete	BPT, BAT,	No discharge of process wastewater pollutants to navigable waters.		
	D. Linoleum and Printed Asphalt	BAT, NSPS	TSS	0.019	0.013
			pH	6.0 - 9.0	
Paint Formulating (Part 446)	[A] A. Oil-Base Solvent Wash Paint	BPT, BAT, NSPS	No discharge of process wastewater pollutants to navigable waters.		
Ink Formulating (Part 447)	[A] A. Oil-Base Solvent Wash Ink	BPT, BAT, NSPS	No discharge of process wastewater pollutants to navigable waters.		
Gum and Wood Chemicals Manufacturing (Part 454) [Expressed in kg/kkg of product]	[A through F] A. Char and Char-Coal Briquets	BPT	No discharge of process wastewater pollutants to navigable waters.		
	B. Tall Oil Resin, Pitch, and Fatty Acids	BPT	BOD_5	0.995	0.529
			TSS	0.705	0.243
			pH	6.0 - 9.0	
Pesticide Chemicals Manufacturing (Part 455) [Expressed in kg/kkg of pesticide chemicals]	[A through C] For two subcategories	BPT	No discharge of process wastewater pollutants to navigable waters.		
	A. Organic Pesticide Chemicals Manufacturing	BPT	COD	13.0	9.0
			BOD_5	7.4	1.6
			TSS	6.1	1.8
			Pesticide Chemicals	0.010	0.0018
			pH	6.0	to 9.0
Explosives Manufacturing (Part 457) [Expressed in kg/kkg of product]	[A through C] NOTE: For subcategory B, standards are in "reserve" status				
	A. Manufacture of Explosives	BPT	COD	7.77	2.59
			BOD_5	0.72	0.24
			TSS	0.25	0.084
			pH	6.0 - 9.0	
	C. Explosives Load Assemble, and Pack Plants	BPT	Oil and Grease	0.11	0.035

TABLE 31. (continued)

Category	Subcategory	Basis	Pollutant or effluent characteristic	Maximum for any one day	Average of daily values for 30 consecutive days shall not exceed:
Carbon Black Manufacturing (Part 458)	[A through D] All subcategories	BPT	No discharge of process wastewater pollutants to navigable waters.		
Photographic (Part 459) [Expressed in kg/1000 m^2 of product]	[A] A. Photographic Processing	BPT	Silver	0.14	0.07
			Cyanide	0.18	0.09
			pH	6.0 - 9.0	
Hospital (Part 460) [Expressed in kg/1000 occupied beds]	[A] A. Hospital	BPT	BOD_5	41.0	33.6
			TSS	55.6	33.8
			pH	6.0 - 9.0	

TABLE 32. SELECTED PRETREATMENT STANDARDS

Category	Subcategory	Basis	Pollutant or effluent characteristic	Maximum for any one day	Average of daily values for 30 consecutive days shall not exceed:
Textiles (Part 410)	[A through G]				
	All subcategories	Existing sources	Prohibited wastes per 40 CFR 128.131*		
		New sources	Prohibited wastes per 40 CFR 128.131 plus NSPS for incompatible pollutants†		
Electroplating (Part 413) [Expressed as mg]	For all subcategories	Proposed for existing sources discharging <38,000 liters/day of process wastewater	Prohibited wastes per 40 CFR 128.131* plus:		
			Cyanide amenable to chlorination	2.0	0.8
			Hexavalent chromium	0.25	0.09
			Lead	0.8	0.4
			Cadmium	1.0	0.5
		Proposed for existing sources discharging >38,000 liters/day of wastewater	Prohibited wastes as for plants discharging <38,000 liters/day of process wastewater plus:		
			Cyanide amenable to chlorination	0.2	0.8
			Cyanide, Total	0.64	0.24
			Copper	4.6	2.0
			Nickel	3.6	1.8
			Total chromium	4.2	1.6
			Zinc	3.4	1.5
			Total metals	7.5	3.9
	B. Precious metals	Proposed for existing sources discharging >38,000 liters/day of wastewater	Prohibited wastes as for plants discharging >38,000 liters/day of process wastewater (all subcategories) plus:		
			Silver	1.0	0.34
Inorganic chemicals manufacturing)Part 415) [Expressed as mg]	[A through BK]				
	A. Aluminum chloride production	Existing sources	Prohibited wastes per 40 CFR 128.131* plus:		
			pH	5.0	10.0
		New sources	Prohibited wastes per 40 CFR 128 plus NSPS for incompatible pollutants†		
	B. Aluminum sulfate production	Existing sources	Prohibited wastes per 40 CFR 128.131* plus:		
			Zinc	5.0	2.5
	L. Potassium dichromate production	Existing sources	Prohibited wastes per 40 CFR 128.131* plus:		
			Hexavalent chromium	0.25	0.09
			Total chromium	3.0	1.0
	AH. Copper sulfate production	Existing sources	Prohibited wastes per 40 CFR 128.131* plus:		
			Copper	1.0	0.5
			Nickel	2.0	1.0
	AR. Lead monoxide production	Existing sources	Prohibited wastes per 40 CFR 128.31* plus:		
			Lead	2.0	1.0
	BA. Silver nitrate production	Existing sources	Prohibited wastes per 40 CFR 128.131* plus:		
			Silver	1.0	0.5

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[a] 40 CFR, Part 410-429.

TABLE 32. (continued)

Category	Subcategory	Basis	Pollutant or effluent characteristic	Maximum for any one day	Average of daily values for 30 consecutive days shall not exceed:
Steam electric power generating (Part 423)	[A through D]				
	For 3 subcategories	Existing sources	Prohibited wastes per 40 CFR 128.31* plus:		
			No discharge of polychlorinated biphenyl compounds		
			Copper not to exceed flow of metal cleaning wastes x 1 mg/liter		
			Oil and grease in combined discharges not to exceed flow of combined discharge x 100 mg/liter		
		New sources	Prohibited wastes per 40 CFR 128 plus NSPS but with no limitations on heat, free available chlorine, and total residue chlorine		
Leather tanning (Part 425)	[A through F]				
	For all subcategories	Existing sources	Prohibited wastes per 40 CFR 128.131*		
		New sources	Prohibited wastes per 40 CFR 128 plus NSPS for incompatible pollutants+		
Petroleum refining (Part 419) [Expressed in mg]	[A through E]				
	All subcategories	Existing sources	Prohibited wastes per 40 CFR 128.31* plus:		
			Ammonia (as N)	100	
			Oil and grease	100	
		New sources	Prohibited wastes per 40 CFR 128.131 plus NSPS for incompatible pollutants+		
Nonferrous metals manufacturing (Part 421) [Expressed as mg]	[A through H]				
	C. Secondary aluminum smelting	Existing sources -- metal coating	Prohibited wastes per 40 CFR 128.131* plus:		
			Oil and grease	100	
		Existing sources -- demagging fume scrubbers	Prohibited wastes per 40 CFR 128.131* plus:		
			pH	5	to 10
		New sources	Prohibited wastes per 40 CFR 128 plus NSPS for incompatible pollutants+		
	F. Secondary copper	Existing sources	Prohibited wastes per 40 CFR 128.31* plus:		
			Copper	1.0	0.5
			Cadmium	0.4	0.2
Timber products (Part 429) [Expressed in mg]	[A through M; Q and R]				
	F. Wood preserving	Existing sources	No discharge of process wastewater pollutants		
		New sources	Prohibited wastes per 40 CFR 128 less Sec. 128.133*+		
	G. Wood preserving steam	Existing sources	Prohibited wastes per 40 CFR 128.131* plus:		
			Oil and grease	100	20.5
			Copper	5	0.62
			Chromium	4	0.41
			Arsenic	4	0.41
	For nine subcategories	New sources	Prohibited wastes per 40 CFR 128 less Sec. 128.133*+		

TABLE 33. POLLUTANTS AND WATER QUALITY CHARACTERISTICS ADDRESSED BY EFFLUENT STANDARDS

Aluminum
Ammonia
Ammonia (as N)
Arsenic
Asbestos
Barium
Cadmium
Chlorine (free available)
Chrome
Chromium; total
Chromium; dissolved
Chromium VI
Copper
Copper; dissolved
Cyanide (total)
Cyanide (amenable to chlorination)

Fluorides
Fluoride (as F)
Gold
Iridium
Iron
Iron; dissolved
Iron; filtrable
Lead
Manganese
Mercury
Nickel
Nickel; dissolved
Nitrate
Nitrate (as N)
Organic nitrogen (as N)
Osmium
Palladium

PCB compounds
Phenol
Phenolic compounds
Phosphorus
Phosphorus (as P)
Phosphorus, elemental
Platinum
Radium ^{226}; total
Radium ^{226}; dissolved
Rhodium
Ruthenium
Selenium
Silver
Sulfate
Uranium
Zinc

BOD_5
COD
pH
TKN
TSS

Color
Debris
Fecal coliform
Oil and grease
Settleable solids

Suspended solids
Drilling muds & cuttings
Water
Sand
Deck drainings

TABLE 34. CATEGORIES AND SUBCATEGORIES NOT REQUIRING ANALYSIS (BPT=BAT)

Grain Mills

Normal wheat flour milling
Normal rice milling
Animal feed
Hot cereal

Fertilizer

Phosphate
Ammonia
Ammonium sulfate production
Mixed and blend fertilizer production

Glass Manufacturing

Sheet glass manufacturing
Rolled glass manufacturing

Vapor Absorption

Solvent Recovery

Cement Manufacturing

Nonleaching
Materials storage piles, runoff

Feedlots

All subcategories except ducks

Phosphate Manufacturing

Defluorinated phosphate rock
Defluorinated phosphoric acid

Ferroalloys Manufacturing

Other calcium carbide furnaces

Asbestos Manufacturing

Asbestos millboard
coating or finishing of asbestos textiles

TABLE 35. CATEGORIES AND SUBCATEGORIES OF INDUSTRIES WHERE BAT EFFLUENT LIMITATIONS WERE DETERMINED TO BE COST-EFFECTIVE (BCT = BAT)

Dairy
All subcategories

Grain Mills

Corn, wet
Corn, dry
Parboiled rice
Ready-to-eat cereal
Wheat starch and gluten

Canned and Preserved Fruits and Vegetables

Apple juice
Citrus products
Frozen potato
Dehydrated potato
Canned and preserved vegetables
Canned and miscellaneous specialties

Canned and Preserved Seafoods

Fish meal
West coast hand-butchered salmon
West coast mechanical salmon processing
Non-Alaskan conventional bottom fishing
Non-Alaskan mechanized bottom fishing
Hand-shucked clams
Mechanized clam processing
Pacific hand-shucked oysters
Atlantic and Gulf hand-shucked oysters
Steamed and canned oyster processing
Sardine processing
Non-Alaskan herring fillet processing
Abalone processing

Sugar Processing

Beet sugar
Liquid cane sugar

Feedlots

Ducks

Ferroalloys

Open electric furnaces wet
Covered electric furnaces and other smelting operations with wet air pollution control devices
Slag processing

Glass

Insulation fiberglass
Plate glass manufacturing
Float glass manufacturing

Table 35. (continued)

Asbestos
All additional categories (7)
Meat Products
Sausage and luncheon meats processor
Ham processor
Canned meats processor
Renderer
Phosphates
Sodium phosphates

TABLE 36. INDUSTRIAL CATEGORIES AND SUBCATEGORIES REQUIRING NEW BCT LIMITS

Grain Mills
Bulgar wheat

Canned and Preserved Fruits and Vegetables
Apple products
Canned and preserved fruits

Canned and Preserved Seafoods
Farm raised catfish
Conventional blue crab
Mechanical blue crab
Nonremote Alaskan crab
Remote Alaskan crab
Nonremote Alaskan whole crab
Remote Alaskan whole crab
Dungeness and tanner crab
Nonremote Alaskan shrimp
Remove Alaskan shrimp
Northern shrimp
Southern nonbreaded shrimp
Breaded shrimp
Tuna

Sugar Processing
Crystalline cane sugar

Cement
Leaching

Ferroalloys
Covered calcium carbide wet
Electrical Manganese
Electrical chromium

Glass
Auto tempering
Auto laminating
Container
Tubing
TV picture tube
Incandescent
Hand pressed and blown

Meat Products
Simple slaughterhouse
Complex slaughterhouse
Low processing packing house
High processing packing house
Small processor meat cutter

TABLE 37. COMPOUNDS INITIALLY DESIGNATED TOXIC POLLUTANTS UNDER SECTION 307a OF THE FWPCA[a]

Aldrin/dieldrin[b]
Benzidine[b]
Cadmium
Cyanide
DDT, (DDD, DDE)[b]
Endrin[b]
Mercury
PCBs[b]
Toxaphene[b]

[a] 65 pollutants listed in the Settlement Agreement were designated toxic pollutants and added to the initial list under the Clean Water Act Amendments of 1977. See Table 24.

[b] Regulations adopted 1977.

TABLE 38. TOXIC POLLUTANT EFFLUENT STANDARDS

Pollutant	Ambient water criterion	Source regulated	Regulation
Aldrin/dieldrin	0.003 µg/ℓ	All manufacturers and formulators: Existing and new sources	Prohibited in any discharge.
DDT, DDD, DDE	0.001 µg/ℓ	All manufacturers and formulators: Existing and new sources	Prohibited in any discharge.
Endrin	0.004 µg/ℓ	Manufacturers: Existing sources	Discharge concentration not to exceed average of 1.5 µg/ℓ per working day calculated over any calendar month; shall not exceed a monthly average daily loading of 0.0006 kg/kkg of endrin produced; and shall not exceed 7.5 µg/ℓ in a sample representing any working day.
		New sources	Discharge concentration not to exceed average of 0.1 µg/ℓ per working day calculated over any calendar month; shall not exceed a monthly average daily loading of 4 x 10^{-5} kg/kkg of endrin produced; and shall not exceed 0.5 µg/ℓ in a sample representing any working day.
		Formulators: Existing and new sources	Prohibited in any discharge.
Toxaphene	0.005 µg/ℓ	Manufacturers: Existing sources	Discharge concentration not to exceed average of 1.5 µg/ℓ per working day calculated over any calendar month; shall not exceed a monthly average daily loading of 3 x 10^{-5} kg/kkg of toxaphene produced; and shall not exceed 7.5 µg/ℓ in a sample representing any working day.
		Manufacturers: New sources	Discharge concentration not to exceed average of 0.1 µg/ℓ per working day calculated over any calendar month; shall not exceed a monthly average daily loading of 2 x 10^{-6} kg/kkg of toxaphene produced; and shall not exceed 0.5 µg/ℓ in a sample representing any working day.
		Formulators: Existing and new sources	Prohibited in any discharge.
Benzidine	0.1 µg/ℓ	Manufacturers: Existing and new sources	Discharge concentration not to exceed average of 10 µg/ℓ per working day calculated over any calendar month; shall not exceed a monthly average daily loading of 0.130 kg/kkg of benzidine produced; and shall not exceed 50 µg/ℓ in a sample representing any working day.
		Applicators: Existing and new sources	Discharge concentration not to exceed average of 10 µg/ℓ per working day calculated over any calendar month; and shall not exceed 25 µg/ℓ in a sample representing any working day.

TABLE 38. (continued)

Pollutant	Ambient water criterion	Source regulated	Regulation
Polychlorinated biphenyls (PCBs)	0.001 µg/ℓ	Manufacturers:	
		Existing and new sources	Prohibited in any discharge.
		Electrical capacitor manufacturers:	
		Existing and new sources	Prohibited in any discharge.
		Electrical transformer manufacturers:	
		Existing and new sources	Prohibited in any discharge.

TABLE 39. HAZARDOUS SUBSTANCES

Material
Acetaldehyde
Acetic Acid
Acetic Anhydride
Acetone Cyanohydrin
Acetyl Bromide
Acetyl Chloride
Acrolein
Acrylonitrile
Aldrin
Ally Alcohol
Aluminum Sulfate
Ammonia
Ammonium Acetate
Ammonium Benzoate
Ammonium Bicarbonate
Ammonium Bichromate
Ammonium Bifluoride
Ammonium Bisulfite
Ammonium Carbamate
Ammonium Carbonate
Ammonium Chloride
Ammonium Chromate
Ammonium Citrate
Ammonium Fluoride
Ammonium Hydroxide
Ammonium Oxalate
Ammonium Silicufluoride
Ammonium Sulfamate
Ammonium Sulfide
Ammonium Sulfite
Ammonium Tartrate
Ammonium Thiocyanate
Ammonium Thosulfate
Aniline
Antimony Pentachloride
Antimony Potassium Tartrate
Antimony Tribromide
Antimony Trichloride
Antimony Trifluoride
Antimony Trioxide
Arsenic Disulfide
Arsenic Pentoxide
Arsenic Trichloride
Arsenic Trioxide
Arsenic Trisulfide
Barium Cyanide
benzoic Acid
Benzonitrile
Benzoyl Chloride
Benzyl Chloride
Beryllium Chloride
Berryllium Flouride
Beryllium Nitrate
Butyl Acetate
Butylamine
Butyric Acid
Cadmium Acetate
Cadmium Bromide
Cadmium Chloride
Calcium Arsenate
Calcium Arsenite
Calcium Carbide
Calcium Chromate
Calcium Cyanide
Calcium Dodecylbenzenesulfonate
Calcium Hydroxide
Calcium Hypochlorite
Calcium Oxide
Captan
Carbaryl
Carbon Disulfide
Chlordane
Chlorine
Chlorobenzene
Chloroform
Chloropyrifos
Chlorosulfonic Acid
Chromic Acetate
Chromic Acid
Chromic Sulfate
Chromous Chloride
Cobaltous Bromide
Cobaltous Formate
Cobaltous Sulfamate
Coumaphos
Cresol
Cupric Acetate
Cupric Acetoarsenite
Cupric Chloride
Cupric Nitrate
Cupric Oxalate
Cupric Sulfate
Cupric Sylfate
Ammoniated
Cupric Tartrate
Cyanogen Chloride
2,4-D Acid
2,4-D Esters
DDT
Diazinon
Dicamba
Dichlobenil
Dichlone
2,2-Dichloropropionic Acid
Dichlorvos
Dieldrin
Diethylamine
Dimethylamine
Dinitrobenzene
Dinitrophenol
Diquat
Disulfoton
Diuron
Dodecylbenzenesulfonic Acid
Endosulfan
Endrin
Ethion
Ethylenediamine
EDTA
Ferric Ammonium Citrate
Ferric Ammonium Oxalate
Ferric Chloride
Ferric Fluoride
Ferric Nitrate
Ferric Sulfate
Ferrous Ammonium Sulfate
Ferrous Chloride
Ferrous Sulfate
Formaldehyde
Formic Acid
Fumaric Acid
Furfural
Guthion
Heptachlor
Hydrochloric Acid
Hydrofluoric Acid
Hydrogen Cyanide
Isopropanolamine
Dodecylbenzenesulfonate
Kelthane
Lead Acetate
Lead Arsenate
Lead Chloride
Lead Fluoborate
Lead Fluoride
Lead Iodide
Lead Nitrate
Lead Stearate
Lead Sulfate
Lead Sulfide
Lead Thiocyanate
Lindane
Lithium Chromate
Malathion
Maleic Acid
Maleic Anhydride
Mercuric Cyanide
Mercuric Nitrate
Mercuric Sulfate
Mercuric Thiocyanate
Mercurous Nitrate
Mercuric Sulfate
Mercuric Thiocyanate
Mercurous Nitrate
Methoxychlor
Methyl Mercaptan
Methyl Parathion
Mevinphos
Mexacarbate
Monoethylamine
Monomethylamine
Naled
Napthalene
Naphthenic Acid
Nickel Ammonium Sulfate
Nickel Chloride
Nickel Hydroxide
Nickel Nitrate
Nickel Sulfate
Nitric Acid
Nitrobenzene
Nitrogen Dioxide
Nitrophenol
Paraformaldehyde
Parathion
Pentachlorophenol
Phenol
Phosgene
Phosphoric Acid
Phosphorous
Phosphorous Oxychloride
Phosphorous Pentasulfide
Phosphorous Trichloride
Potassium Arsenate
Potassium Arsenite
Potassium Bichromate
Potassium Chromate
Potassium Cyanide
Potassium Hydroxide
Potassium Permanganate
Propionic Acid
Propionic Anhydride
Pyrethrins
Quinoline
Resorcinol
Selenium Oxide
Sodium
Sodium Arsenate
Sodium Arsenite
Sodium Bichromate
Sodium Bifluoride
Sodium Bisulfite
Sodium Chromate
Sodium Cyanide
Sodium Dodecylbenzenesulfonate
Sodium Floride
Sodium Hydrosulfide
Sodium Hydroxide
Sodium Hypochlorite
Sodium Methylate
Sodium Nitrite
Sodium Phosphate Dibasic
Sodium Phosphate Tribasic
Sodium Selenite
Strontium Chromate
Strychnine
Sulfuric Acid
Sulfur Monochloride
2,4,5-T Acid
2,4,5-T Esters
TDE
Tetraethyl Pyrophosphate
Toxaphene
Trichlorfon
Trichlorophenol
Triethanolamine Dodecylbenzenesulfonate
Triethylamine
Trimethylamine
Uranyl Acetate
Uranyl Nitrate
Vanadium Pentoxide
Vanadyl Sulfate
Vinyl Acetate
Xylenol
Zinc Acetate
Zinc Ammonium Chloride
Zinc Borate
Zinc Bromide
Zinc Carbonate
Zinc Chloride
Zinc Cyanide
Zinc Flouride
Zinc Formate
Zinc Hydrosulfite
Zinc Nitrate
Zinc Pehnolsulfonate
Zinc Phosphide
Zinc Silicofluoride
Zinc Sulfate
Zirconium Nitrate
Zirconium Potassium Fluoride
Zirconium Sulfate
Zirconium Tetrachloride

TABLE 40. CHEMICALS DESIGNATED HAZARDOUS UNDER SECTION 311 OF THE FWPCA (PROPOSED)

1. Adipic acid
2. n-Butyl phthalate
3. Carbofuran
4. Carbon tetrachloride
5. Crotonaldehyde
6. Dichlorobenzenes
7. Dichloropropane
8. Dichloropropene
9. Dichloropropene-dichloropropane mixture
10. Dinitrotoluene
11. Epichlorohydrin
12. Ethylene dibromide
13. Ethylene dichloride
14. Hexachlorocyclopentadiene
15. Hydrogen sulfide
16. Kepone
17. Mercaptodimethur
18. Nitrotoluenes
19. Propargite
20. Propylene oxide
21. Silver nitrate
22. 2,4,5-T amines
23. 2,4,5-T salts
24. 2,4,5-TP acid
25. 2,4,5-TP acid esters
26. Thallium sulfate
27. Trichloroethylene
28. Vinylidene chloride

5.0 SAFE DRINKING WATER ACT

The Safe Drinking Water Act of 1974 amends the Public Health Service Act and is established to assure that the public is provided with safe drinking water. The Safe Drinking Water Act provides the legislative initiative under which Primary and Secondary Drinking Water Regulations are promulgated by EPA. These regulations apply to water after treatment by all public drinking water systems. This act also (1) provides for the protection of underground sources of drinking water, (2) assures that there will be adequate supplies of chemicals needed to treat public water systems, and (3) establishes the National Drinking Water Advisory Council to make recommendations to the EPA about matters relating to this act.

The National Drinking Water Advisory Council consists of 15 members, appointed for three-year rotating terms. The membership consists of five members from the general public, five from State and local water hygiene and public water supply agencies, and five from private groups or organizations interested in water hygiene and public water supplies.

Interim Primary Drinking Water Regulations have been adopted by EPA under the Safe Drinking Water Act to protect public health. These regulations specify maximum levels for certain contaminants in public drinking water. Secondary drinking water regulations have been proposed as guidelines to the States for setting regulations to assure non-health related qualities of drinking water. Some of the qualities considered by these regulations are color, odor, corrosivity, and taste.

5.1 NATIONAL INTERIM PRIMARY DRINKING WATER REGULATIONS

In 1975, under the Safe Drinking Water Act, EPA adopted National Interim Primary Drinking Water Regulations specified at 40 CFR, Part 141. The regulations specify maximum levels for several organic and inorganic contaminants, microbiological contamination, and turbidity. Regulations covering radionuclides in drinking water were added in 1976.

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Additional Primary Drinking Water Regulations were proposed in January 1978 to control additional organic pollutants.

The maximum levels set forth (other than fluorides) in the Primary Drinking Water Regulations for inorganics are listed in Table 41. Maximum levels set for fluorides depend on the average of the maximum daily air temperatures for the location of the community water supply. Table 42 lists the maximum allowable fluoride levels for various temperature ranges. Table 43 presents the maximum contaminant levels for organic chemicals. These levels apply only to community water systems.

The maximum contaminant levels for turbidity are applicable to both community and noncommunity water systems using surface water sources in whole or in part. The maximum contaminant levels must meet both of the following criteria for turbidity in drinking water, measured at a representative entry point(s) to the distribution system. The standards are:

1. One turbidity unit (TU), as determined by a monthly average except that five or fewer turbidity units may be allowed if the supplier of water can demonstrate to the State that the higher turbidity does not do any of the following:
    a. Interfere with disinfection.
    b. Prevent maintenance of an effective disinfectant agent throughout the distribution system.
    c. Interfere with microbiological determinations.
2. Five turbidity units based on an average for two consecutive days.

The maximum contaminant levels for coliform bacteria, applicable to community and noncommunity water systems, are given below.

When the membrane filter technique is used, the number of coliform bacteria shall not exceed any of the following:

1. One/100 ml as the arithmetic mean of all samples examined per month.
2. Four/100 ml in more than one sample when less than 20 are examined per month.
3. Four/100 ml in more than five percent of the samples when 20 or more are specified per month. Levels based on an alternate test method are also specified.

Primary drinking water regulations for radionuclides are given in Section 5.2. The propsed primary drinking water regulations are discussed in Section 5.3.

5.2 NATIONAL INTERIM PRIMARY DRINKING WATER REGULATIONS FOR RADIONUCLIDES

The regulations presented below were adopted in 1976 under the Clean Water Act as part of the National Interim Primary Drinking Water Regulations. They are specified at 40 CFR, Part 141. The regulations follow.

5.2.1 Maximum Contaminant Levels for Radium-226, Radium-228, and Gross Alpha Particle Radioactivity in Community Water Systems

The following are the maximum contaminant levels for radium-226, radium-228, and gross alpha particle radioactivity.

1. Combined radium-226 and radium-228, 5 pCi/l.
2. Gross alpha particle activity (including radium-226 but excluding radon and uranium), 5pCi/l.

5.2.2 Maximum Contaminant Levels for Beta Particle and Proton Radioactivity from Manmade Radionuclides in Community Water Systems

The average annual concentration of beta particle and proton radioactivity from manmade radionuclides in drinking water shall not produce an annual dose equivalent to the total body or any internal organ greater than 4 millirem/yr.

Except for the radionuclides listed in Table 44, the concentration of manmade radionuclides causing millirem total body or organ dose equivalents shall be calculated on the basis of a 2-liter/day drinking water intake using the 168-hour data listed in "Maximum Permissible Body Burdens and Maximum Permissible Concentration of Radionuclides in Air or Water for Occupational Exposure," NBS Handbook 69 as amended August 1963, U.S. Department of Commerce. If two or more radionuclides are present, the sum of their annual dose equivalent to the total body or to any organ shall not exceed 4 millirem/yr.

5.3 PROPOSED PRIMARY DRINKING WATER REGULATIONS

Primary Drinking Water Regulations were proposed by EPA in January 1978 to control trihalomethanes and other synthetic organic chemical contaminants (43 CFR, Part 13077). The proposed regulations establish a maximum contaminant level of 0.10 mg/l total trihalomethanes (TTHM) and a prescribed treatment technique requirement to reduce levels of other pollution related synthetic organic chemicals to the maximum extent feasible.

TTHMS, including chloroform, occur in drinking water as a result of the interaction of chlorine, applied for disinfection and other purposes, with naturally occurring organic substances in raw water. The regulations to control pollution related synthetic organic chemicals in drinking water have been proposed because there is evidence to suggest that long-term exposure to low levels of organic chemicals may increase the risk of human cancer and other chronic effects. Initially the proposed regulations will apply only to those systems serving a population of greater than 75,000. If adopted, these regulations will be added at 40 CFR, Part 141.

Since monitoring for the presence of all synthetic organic chemicals is not technologically or economically feasible, the proposed regulations require that synthetic organic pollutants should be controlled by using granulated activated charcoal (GAC). The GAC system should satisfy the following criteria:

1. The concentration in the effluent of any of the volatile halogenated organic compounds (except for TTHMS) determined by the purge-and-trap/gas chromatography method shall not exceed 0.5 μg/l.
2. The removal of influent total organic carbon with fresh activated carbon shall be at least 50 percent.
3. The effluent total organic carbon may not exceed the value with fresh activated carbon by more than 0.5 mg/l.
4. A variance from the GAC treatment technique requirement will be granted to systems for which raw water is furnished from one of the following sources: deep ground water, watersheds protected from manmade pollution, the Great Lakes, or water purchased from a supplier who complied with the regulations.

Other systems may be granted variances provided the prescribed treatment technique is demonstrated to be unnecessary to protect public health. As a guideline, a list of chemicals indicative of industrial pollution is specified and analytical data on these chemicals must be submitted to EPA to establish the quality of the water in systems seeking variances. This list of chemical indicators of pollution for the regulations is presented in Table 45.

5.4 NATIONAL SECONDARY DRINKING WATER REGULATIONS (PROPOSED)

National Secondary Drinking Water Regulations, to be added at 40 CFR, Part 143, were proposed in March 1977. These regulations propose maximum levels for certain contaminants that by their presence in excessive quantities may discourage the utilization of a public drinking supply. While primary regulations prescribe maximum contaminant limits to protect public health, secondary regulations deal with such qualities as taste, color, odor, and corrosivity for drinking water.

Table 46 lists the maximum contaminant levels specified in the proposed secondary regulations.

5.5 UNDERGROUND INJECTION CONTROL FOR THE PROTECTION OF UNDERGROUND DRINKING WATER SUPPLY

The EPA issued a list on September 25, 1978 (43 FR-4320), of 22 States required to formulate regulations to protect underground drinking water supplies from contamination of deep-well injection of toxic substances. According to the EPA, a deep well is any hole dug, bored, or drilled in the ground that is deeper than its largest surface dimension. The material to be controlled is any substance that would endanger the quality of the drinking waters by either causing adverse health effects or making the water unpalatable. These regulations specifically exclude deep well operations concerned with oil or natural gas production provided they do not endanger drinking waters. If no underground drinking water sources occur in an area, that area need not be concerned with making deep well injection control regulations. The 22 States required to propose such regulations are listed in Table 47. The remaining States will be required to formulate such regulations at a later date.

5.6 PROTECTION OF SOLE, OR PRINCIPAL SOURCE AQUIFER

These regulations are designed to protect any aquifer that is determined to be the sole or principal drinking water sources for any large population and whose contamination would result in a significant hazard to public health. A significant hazard means that the level of any contaminant exceeds the National Interim Primary Drinking Waters Standards for that pollutant. When an aquifer is thus designated, the EPA also publishes a description of the boundaries of its recharge zone. All major projects within this recharge zone area are required to be reviewed for groundwater impacts. All environmental impact statements required for federal projects proposed in the recharge zone must also consider groundwater contamination. At this time, the Edwards Underground Reservoir for San Antonio, Texas, Santa Cruz County of Aquifer in California, the Spokane Valley-Rathdrum Prairie Aquifer in Idaho and Washington, and the Biscayne Aquifer in Florida are the only underground water thus designated.

TABLE 41. DRINKING WATER INORGANICS LEVELS
(not to be exceeded in community water systems)

Contaminant	Level, milligrams per liter
Arsenic	0.05
Barium	1
Cadmium	0.010
Chromium	0.05
Lead	0.05
Mercury	0.002
[a]Nitrate (as N)	10
Selenium	0.01
Silver	0.05

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[a] Applicable to community and noncommunity water systems.

TABLE 42. DRINKING WATER FLUORIDE LEVELS
(not to be exceeded)

Temperature[a]		Level, milligrams per liter
Degrees Fahrenheit	Degrees Celsius	
53.7 and below	12.0 and below	2.4
53.8 to 58.3	12.1 to 14.6	2.2
58.4 to 63.8	14.7 to 17.6	2.0
63.9 to 70.6	17.7 to 21.4	1.8
70.7 to 79.2	21.5 to 26.2	1.6
79.3 to 90.5	26.3 to 32.5	1.4

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[a] Annual average daily maximum temperature.

TABLE 43. DRINKING WATER ORGANICS LEVELS (not to be exceeded)

Contaminant	Level, milligrams per liter
(a) Chlorinated hydrocarbons	
Endrin (1,2,3,4,10, 10-hexachloro-6,7-epoxy-1,4 4a,5,6,7,8,8a-octahydro-1,4,-endo,endo-5,8-dimethano naphthalene).	0.0002
Lindane (1,2,3,4,5,6-hexachlorocyclohexane, gamma isomer)	0.004
Methoxychlor (1,1,1-Trichloro-2,2-bis[p-methoxyphenyl] ethane).	0.1
Toxaphene ($C_{10}H_{10}Cl_8$-Technical chlorinated camphene, 67-69% chlorine).	0.005
(b) Chlorophenoxys:	
2,4-D, (2,4-Dichlorophenoxyacetic acid).	0.1
2,4,5-TP Silvex (2,4,5-Trichlorophenoxypropionic acid).	0.01

TABLE 44. AVERAGE ANNUAL CONCENTRATIONS ASSUMED TO PRODUCE A TOTAL BODY OR ORGAN DOSE OF 4 mrem/yr

Radionuclide	Critical organ	pCi/l
Tritium	Total body	20,000
Strontium-90	Bone marrow	8

TABLE 45. CHEMICAL INDICATORS OF INDUSTRIAL CONTAMINATION

Chemical type	Compound
Industrial Chemicals	Chlorophenols
	2-Chlorovinyl ether
	Dichlorobenzenes
	Dichlorodifluoromethane
	1,1-Dichloroethene
	1,2-Dichloroethene
	Dichloromethane
	1,1-Dichloroethane
	1,2-Dichloroethane
	1,2-Dichloropropane
	1,3-Dichloropropene
	Dinitrotoluenes
	Ethylbenzene
	Hexachlorobenzene
	Hexachlorobutadiene
	Herachlorocyclopentadiene
	Hexachloroethane
	Nitrobenzene
	Phthalate esters
	Polychlorinated biphenyls
	Propylbenzene
	Styrene
	1,1,2,2-Tetrachloroethane
	Tetrachloroethylene
	Toluene
	Trichlorobenzenes
	1,1,1-Trichloroethane
	1,1,2-Trichloroethane
	Trichloroethylene
	Trichlorofluoromethane
	Vinyl Chloride
	Xylenes
	Benzene
	Bis (2-chloroethyl) ether
	Bis (2-chloroisopropy) ether
	Bromobenzene
	4-Bromophenylphenyl ether
	Carbon tetrachloride
	Chlorinated naphthalenes
	Chlorobenzene
	4-Chlorophenylphenyl ether
Pesticides	Aldrin
	Atrazine
	Chlordane
	DDD, DDE, DDT
	Dieldrin
	Endrin
	Heptachlor
	Heptachlor epoxide
	Kepone
	Lindane and Hexachlorocyclohexanes
	Pentachlorophenol
	Toxaphene
Polynuclear Aromatic Hydrocarbons	3,4-Benzofluoranthene
	1,12-Benzoperylene
	11,12-Benzofluoranthene (Benzo(K) Fluoranthene)
	Benzo(a)pyrene
	Fluoranthene
	Indeno(1,2,3-cd)pyrene

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[a] Analytical data on these compounds are to be provided for those systems seeking a variance from the GAC treatment technique requirement proposed.

TABLE 46. SECONDARY MAXIMUM CONTAMINANT LEVELS

Contaminant	Level
Chloride	250 mg/l
Color	15 color units
Copper	1 mg/l
Corrosivity	Noncorrosive
Foaming agents	0.5 mg/l
Hydrogen sulfide	0.05 mg/l
Iron	0.3 mg/l
Manganese	0.05 mg/l
Odor	3 Threshold Odor Number
pH	6.5 - 8.5
Sulfate	250 mg/l
TDS	500 mg/l
Zinc	5 mg/l

TABLE 47. STATES REQUIRED TO FORMULATE DEEP WELL INJECTION REGULATIONS

Arizona
Arkansas
California
Colorado
Florida
Illinois
Indiana
Iowa
Kansas
Kentucky
Louisiana
Michigan
Mississippi
New Mexico
New York
Ohio
Oklahoma
Pennsylvania
Texas
Utah
West Virginia
Wyoming

6.0 OCCUPATIONAL SAFETY AND HEALTH ACT

The Occupational Safety and Health Act of 1970 (PL 91-596, Stat. 1590 et seq.; 29 USC 651 et seq.) intends to assure safe and healthful working conditions by authorizing enforcement of the standards developed under the act, by assisting and encouraging the States in their efforts to assure safe and healthful working conditions and by providing for research, information, education, and training in the field of occupational safety and health. The Occupational Safety and Health Act created the Occupational Safety and Health Administration and charged the agency with the regulatory responsibility to protect workers from hazards of the workplace. The act also created the National Institute for Occupational Safety and Health (NIOSH), which has among its responsibilities the duty to make recommendations for the OSHA regulatory standards.

Both safety and health regulations have been promulgated by OSHA under the Occupational Safety and Health Act. Safety regulations include handling and labeling requirements, safety precautions (such as protective clothing or equipment). Health regulations are exemplified by employee health record requirements, and the setting of contaminant exposure limits and maximum contaminant levels for workplace air. Regulations dealing with specific chemicals encountered in occupational environments are discussed in Section 6.1. Chemicals that may be subject to future regulation by OSHA are also listed in Section 6.1.

Recommendations for regulations are made to OSHA by NIOSH, the scientific advisory body of OSHA and other recognized standards-setting organizations, including the American Conference of Governmental and Industrial Hygienists and the American National Standards Institute. These groups are discussed in Section 6.2.

On October 24, 1978, OSHA revoked 928 unnecessary regulations. These revocations were made to simplify its rules and recordkeeping procedures.

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6.1 OSHA REGULATIONS DEALING WITH OCCUPATIONAL EXPOSURE TO SPECIFIC CHEMICALS

In 1974, OSHA promulgated the first regulations establishing levels of pollutants that would be acceptable for workplace atmosphere. The levels adopted are time weighted averages (TWA) based on 8 hours per day or 40 hours per week exposure. The levels specified reflect the recommended Threshold Limit Values (TLV^R) published by the American Conference of Governmental Industrial Hygienists (ACGIH) in 1968 and the then current American National Standards Institute (ANSI). These regulations are presented in Table 48. Table Z-1 is the 1968 ACGIH TLV^R list. Table Z-2 shows values based upon ANSI recommendations, and Table Z-3 refers to Mineral Dust Concentration, also from the ACGIH standard.

Besides these regulations, occupational standards requiring special precautions and/or protective devices have been adopted or proposed for 20 additional workplace air contaminants. Also, numerical standards have been set or proposed for seven workplace air contaminants. These are found in Table 49.

Table 50 lists the chemical contaminants that have been regulated as potential carcinogens by OSHA. Special handling, protective devices, and minimum contact regulations have been adopted to address these compounds.

NIOSH has also assigned a special designation to ethylene dibromide and disulfiram. Interaction of these compounds is deemed harmful although they are not suspected carcinogens. Ethylene thiourea is also designated as dangerous to health.

All of the regulations discussed above are listed (or to be added in the case of the proposed standards) at 24 CFR, Part 1910, Subpart Z, entitled "Toxic and Hazardous Substances."

6.2 PROPOSED OSHA POLICY ON CARCINOGENS

On October 4, 1977, OSHA proposed a new policy concerning the regulation of suspected carcinogens (42 FR 54148). Under this proposed policy, substances that are confirmed carcinogens will be placed in Category I. In Category I, a substance would be considered a confirmed carcinogen if it is found to be carcinogenic by two different mammalian studies. Emergency temporary standards would then be formulated immediately for Category I substances with permanent standards required in six months. The exposure limit set would be the lowest attainable level. This might include a total ban if a suitable substitute were available. Suspected carcinogens, or substances found to be carcinogenic in one animal species, would be placed in Category II. For Category II substances, a permanent standard would be required to prevent acute or chronic toxic effects, but no time limit on promulgation would be in effect. Category III would be established to include substances for which evidence is insufficient for classification in a higher category. These substances would be listed for additional study, but no standard would be set. Category IV would include substances that could fall in Categories I-III, which are not found in the U.S. workplaces.

On July 14, 1978, OSHA released a preliminary list of 276 chemicals that could be classified as Category I, i.e., confirmed carcinogens under the proposal. There were 290 substances considered for Category II, and 396 chemicals placed in Category III. Compounds appearing on the preliminary list of Category I compounds that are produced in significant quantities in the United States are listed in Table 51. These compounds are the ones most likely to be subject to OSHA regulation in the near future.

6.3 RECOMMENDED CONTAMINANT LIMITS FOR WORKPLACE AIR

Recommendations for contaminant limits in workroom air are made by the National Institute of Occupational Safety and Health by the American Conference of Governmental Industrial Hygienists and by the American National Standards Institute.

NIOSH is the sister research body of OSHA, and its responsibilities include developing criteria for setting occupational standards. This information is generally developed on a substance-by-substance basis, or more recently, in the case of coke oven emissions, on a process basis. Results of the NIOSH literature investigations are published in criteria documents. Preparation of a criteria document addressing a single chemical contaminant or industry requires about 45 weeks. Approximately 24 criteria documents are produced in a year by NIOSH. Table 52 presents a summary of the NIOSH exposure limit recommendations transmitted to OSHA since 1972. A listing of the chemicals, physical agents, and industries proposed to be addressed by NIOSH in 1979-1980 are listed in Table 53. Criteria documents will be prepared for these.

NIOSH also prepares documents addressing health and safety guidelines for various occupations. An example of one of these is a document entitled "Recommended Health and Safety Guidelines for Coal Gasification Pilot Plants." This document addresses the various coal gasification processes and attempts to identify the associated potential health hazards. On the basis of identified hazards, guidelines for worker protection are prescribed in terms of engineering controls, work practices, workplace monitoring, medical surveillance, and personal protection. Table 54 lists those compounds known to be present in coal gasification processes for which occupational standards have been established. Table 55 lists substances suspected to be present for which occupational standards exist.

The American Conference of Governmental Industrial Hygienists is composed of professionals in government agencies or educational institutions who are engaged in occupational safety and health programs. The conference was organized in 1938. The ACGIH publishes annually a listing of Threshold Limit Values (TLVs^R). The TLVs^R address both chemical substances and physical agents and prescribe recommended levels for workroom air based on 10 hours per day or 40 hours per week exposure. Although the published TLVs^R other than the 1968 values (see Table 48) carry no legal status, they provide an indication of exposure levels that may eventually be considered by NIOSH or OSHA. The objective of the ACGIH in recommending TLVs^R is to describe conditions to serve as guides in the control of health hazards. Documentation of the TLVs^R is also published. Table 56 lists specific recommendations advanced in 1977 by ACGIH that were not included in the adopted 1968 listing.

The third organization concerned with occupational standards is the American National Standards Institute (ANSI). ANSI is a federation of national trade, technical, professional, labor, and consumer organizations, government agencies, and individual companies. It coordinates and administers a voluntary standardization system within the United States that is directed toward the protection of consumers and industrial workers. Among the standards endorsed by ANSI are acceptable concentrations of toxic dusts and gases. Publications addressing standards for the chemicals listed in Table 56 have been prepared by ANSI.

A fourth group that should be mentioned here is the American Society of Testing Materials. It also makes recommendations for industrial exposure.

TABLE 48. OSHA REGULATIONS PRESCRIBING LEVELS OF CHEMICALS PERMISSIBLE IN WORKPLACE AIR (29 CFR, 1910, 7)

SUBPART Z--TOXIC AND HAZARDOUS SUBSTANCES

Source: 39 FR 23502, June 27, 1974, unless otherwise noted. Redesignated at 40 FR 27073, May 28, 1975.

§ 1910.1000 Air contaminants.

An employee's exposure to any material listed in Tables Z-1, Z-2, or Z-3 of this section shall be limited in accordance with the requirements of the following paragraphs of this section.

(a) Table Z-1:

(a) Materials with names preceded by "C"-Ceiling Values. An employee's exposure to any material in Table Z-1, the name of which is preceded by a "C" (e.g., C boron trifluoride), shall at no time exceed the ceiling value given for that material in the table.

(b) Other materials--8-hour time weighted averages. An employee's exposure to any material in Table Z-1, the name of which is not preceded by "C," in any 8-hour work shift of a 40-hour workweek, shall not exceed the 8-hour time weighted average given for that material in the table.

(c) Table Z-2:

(a) 8-hour time weighted averages. An employee's exposure to any material listed in Table Z-2, in any 8-hour work shift of a 40-hour workweek, shall not exceed the 8-hour time-weighted average limit given for that material in the table.

(b) Acceptable ceiling concentrations. An employee's exposure to a material listed in Table Z-2 shall not exceed at any time during an 8-hour shift the acceptable ceiling concentration limit given for the material in the table, except for a time period, and up to a concentration, not exceeding the maximum duration and concentration allowed in the column under "acceptable maximum peak above the acceptable ceiling concentration for an 8-hour shift."

TABLE 48. (continued)

(c) Example. During an 8-hour work shift, an employee may be exposed to a concentration of benzene above 25 ppm (but never above 50 ppm) only for a maximum period of 10 minutes. Such exposure must be compensated by exposures to concentrations less than 10 ppm so that the cumulative exposure for the entire 8-hour work shift does not exceed a weighted average of 10 ppm.

(c) Table Z-3: an employee's exposure to any material listed in table Z-3, in any 8-hour work shift of a 40-hour work week, shall not exceed the 8-hour time weighted average limit given for that material in the table.

(d) Computation formulae:

(1) (i) The cumulative exposure for an 8-hour work shift shall be computed as follows:

$$E = \frac{C_a T_a + C_b T_b + \ldots C_n T_n}{8}$$

Where:

E is the equivalent cumulative exposure for the work shift.

C is the concentration during any period of time T where the concentration remains constant.

T is the duration in hours of the exposure at the concentration C.

The value of E shall not exceed the 8-hour time-weighted average limit in Tables Z-1, Z-2, or Z-3 for the material involved.

(ii) To illustrate the formula prescribed in subdivision (i) of this subparagraph, note that isoamyl acetate has an 8-hour time weighted average limit of 100 ppm (Table Z-1). Assume that an employee is subject to the following exposure:

Two hours' exposure at 150 ppm
Two hours' exposure at 75 ppm
Four hours' exposure at 50 ppm.

Substituting this information in the formula, we have

$$\frac{2 \times 150 + 2 \times 75 + 4 \times 50}{8} = 81.25 \text{ ppm}$$

Since 81.25 ppm is less than 100 ppm, the 8-hour time weighted average limit, the exposure is acceptable.

TABLE 48. (continued)

(2) (i) In case of a mixture of air contaminants an employer shall compute the equivalent exposure as follows:

$$E_m = \frac{C_1}{L_1} + \frac{C_2}{L_2} + \ldots \frac{C_n}{L_n}$$

Where:

E_m is the equivalent exposure for the mixture.

C is the concentration of a particular contaminant.

L is the exposure limit for that contaminant, from Table Z-1, Z-2, or Z-3.

The value of E_m shall not exceed unity (1).

(ii) To illustrate the formula prescribed in subdivision (i) of this subparagraph, consider the following exposures:

Material	Actual concentration of 8-hour exposure	8-hour time-weighted average exposure limit
Acetone (Table Z-1)	500 ppm	1,000 ppm
2-Butanone (Table Z-1)	45 ppm	200 ppm
Toluene (Table Z-2)	40 ppm	200 ppm

Substituting in the formula, we have:

$$E_m = \frac{500}{1000} + \frac{45}{200} + \frac{40}{200}$$

$$E_m = 0.500 + 0.225 + 0.200$$

$$E_m = 0.925$$

Since E_m is less than unity (1), the exposure combination is within acceptable limits.

(e) To achieve compliance with paragraphs (a) through (d) of this section, administrative or engineering controls must first be determined and implemented whenever feasible. When such controls are not feasible to achieve

TABLE 48. (continued)

full compliance, protective equipment or any other protective measures shall be used to keep the exposures of employees to air contaminants within the limits prescribed in this section. Any equipment and/or technical measures used for this purpose must be approved for by each particular use by a competent industrial hygienist or other technically qualified person. Whenever respirators are used, their use shall comply with CFR 29, Chapter XV,II Part 1910.134.

TABLE 48. (continued)

TABLE Z-1

Substance	ppm[1/]	mg/m^3[2/]
Acetaldehyde	200	360
Acetic acid	10	25
Acetic anhydride	5	20
Acetone	1,000	400
Acetonitrile	40	70
Acetylene dichloride, see 1,2-Dichloroethylene		
Acetylene tetrabromide	1	14
Acrolein	0	0.25
Acrylamide-Skin		0.3
Acrylonitrile-Skin	20	45
Aldrin-Skin		0.25
Allyl alcohol-Skin	2	5
Allyl chloride	1	3
C Allylglycidyl ether (AGE)	10	45
Allyl propyl disulfide	2	12
2-Aminoethanol, see Ethanolamine		
2-Aminopyridine	0.5	2
Ammonia	50	35
Ammonium sulfamate (Ammate)		15
n-Amyl acetate	100	525
sec-Amyl acetate	125	650
Aniline-Skin	5	19
Anisidine (o, p-isomers)-Skin		0.5
Antimony and compounds (as Sb)		0.5
ANTU (alpha naphthyl thiourea)		0.3
Arsenic and compounds (as As)		0.5
Arsine	0.05	0.2
Azinphosmethyl-Skin		0.2
Barium (soluble compounds)		0.5
p-Benzoquinone, see Quinone		
Benzoyl peroxide		5
Benzyl chloride	1	5
Biphenyl, see Diphenyl		
Biphenyl A, see Diglycidyl ether		
Boron oxide		15
C Boron trifluoride	1	3
Bromine	0.1	0.7
Bromoform-Skin	0.5	5
Butadiene (1,3-butadiene)	1,000	2,200
Butanethiol, see Butyl mercaptan		
2-Butanone	200	590

See footnotes at end of table.

TABLE 48. (continued)

TABLE Z-1 (cont.)

Substance	ppm[1/]	mg/m³[2/]
2-Butoxy ethanol (Butyl Cellosolve)-Skin	50	240
Butyl acetate (n-butyl acetate)	150	710
sec-Butyl acetate	200	950
tert-Butyl acetate	200	950
Butyl alcohol	100	300
sec-Butyl alcohol	150	450
tert-Butyl alcohol	100	300
C Butylamine-Skin	5	15
C tert-Butyl chromate as (CrO_2)-Skin		0.1
n-Butyl glycidyl ether (BGE)	50	270
Butyl mercaptan	10	35
p-tert-Butyltoluene	10	60
Calcium arsenate		1
Calcium oxide		5
Camphor	2	
Carbaryl (Sevin ®)		5
Carbon black		3.5
Carbon dioxide	5,000	9,000
Carbon monoxide	50	55
Chlordane-Skin		0.5
Chlorinated camphene-Skin		0.5
Chlorinated diphenyl oxide		0.5
Chlorine	1	3
Chlorine dioxide	0.1	0.3
C Chlorine trifluoride	0.1	0.4
C Chloroacetaldehyde	1	3
α-Chloroacetophenone (phenacylchloride)	0.05	0.4
Chlorobenzene (monochlorobenzene)	75	350
o-Chlorobenzyliden malononitrile (OCBM)	0.05	0.4
Chlorobromomethane	200	1,050
2-Chloro-1.3-butadiene, see Chloroprene		
Chlorodiphenyl (42 percent Chlorine)-Skin		1
Chlorodiphenyl (54 percent Chlorine)-Skin		0.5
1-Chloro,2,3-epoxypropane, see Epichlorhydrin		
2-Chloroethanol, see Ethylene chlorohydrin		
Chloroethylene, see Vinyl chloride		
C Chloroform (trichloromethane)	50	240
1-Chloro-1-nitropropane	20	100
Chloropicrin	0.1	0.7
Chloroprene (2-chloro-1,3-butadiene)-Skin	25	90

See footnotes at end of table.

TABLE 48. (continued)

TABLE Z-1 (cont.)

Substance	ppm[1/]	mg/m^3[2/]
Chromium, sol. chromic, chromous salts as Cr		0.5
Metal and insol. salts		1
Coal tar pitch volatiles (benzene soluble fraction) anthracene, BaP, phenanthrene, acridine, chrysene, pyrene		0.2
Cobalt, metal fume and dust		0.1
Copper fume		0.1
Dusts and Mists		1
Cotton dust (raw)		1
Crag® herbicide		15
Cresol (all isomers)-Skin	5	22
Crotonaldehyde	2	6
Cumene-Skin	50	245
Cyanide (as CN)-Skin		5
Cyclohexane	300	1,050
Cyclohexanol	50	200
Cyclohexanone	50	200
Cyclohexene	300	1,015
Cyclopentadiene	75	200
2,4-D		10
DDT-Skin		1
DDVP, see Dichlorvos		
Decaborane-Skin	0.05	0.3
Demeton®-Skin		0.1
Diacetone alcohol (4-hydroxy-methyl-1-2-pentanone)	50	240
1,2-diaminoethane, see Ethylenediamine		
Diazomethane	0.2	0.4
Diborane	0.1	0.1
Dibutylphthalate		5
C o-Dichlorobenzene	50	300
p-Dichlorobenzene	75	450
Dichlorodifluoromethane	1,000	4,950
1,3-Dichloro-5.5-dimethyl hydantoin		0.2
1,1-Dichloroethane	100	400
1,2-Dichloroethylene	200	790
C Dichloroethyl ether-Skin	15	90
Dichloromethane, see Methylene chloride (table Z-2)		
Dichloromonofluoromethane	1,000	4,200

See footnotes at end of table.

TABLE 48. (continued)

TABLE Z-1 (cont.)

Substance	ppm 1/	mg/m^3 2/
C 1,1-Dichloro-1-nitroethane	10	60
1,2-Dichloropropane, see Proplyene dichloride		
Dichlorotetrafluoroethane	1,000	7,000
Dichlorvos (DDVP)-Skin		1
Diedrin-Skin		0.25
Diethylamine	25	75
Diethylamino ethanol-Skin	10	50
Diethylether, see Ethyl ether		
Difluorodibromomethane	100	860
C Diglycidyl ether (DGE)	0.5	2.8
Dihydroxybenzene, see Hydroquinone		
Diisobutyl ketone	50	290
Diisopropylamine-Skin	5	20
Dimethoxymethane, see Methylal		
Dimethyl acetamide-Skin	10	35
Dimethylamine	10	18
Dimethylaminobenzene, see Xylidene		
Dimethylaniline (N-dimethylaniline)-Skin	5	25
Dimethylbenzene, see Xylene		
Dimethyl 1,2-dibromo-2,2-dichlorethyl phosphate, (Dibrom)		3
Dimethylformamide-Skin	10	30
2,6-Dimethylheptanone, see Diisobutyl ketone		
1,1-Dimethylhydrazine-Skin	0.5	1
Dimethylphthalate		5
Dimethylsulfate-Skin	1	5
Dinitrobenzene (all isomers)-Skin		1
Dinitro-o-cresol-Skin		0.2
Dinitrotoluene-Skin		1.5
Dioxane (Diethylene dioxide)-Skin	100	360
Diphenyl	0.2	1
Diphenylmethane diisocyanate, see Methylene bisphenyl isocyanate (MDI)		
Dipropylene glycol methyl ether-Skin	100	600
Di-sec, octylphthalate (Di-2-ethylhexylphthalate		5
Endrin-Skin		0.1
Epichlorhydrin-Skin	5	19
EPN-Skin		0.5
1,2-Epoxypropane, see Propylene oxide		

See footnotes at end of table.

TABLE 48. (continued)

TABLE Z-1 (cont.)

Substance	ppm[1]	mg/m³[2]
2,3-Epoxy-1-propanol, see Glycidol		
Ethanethiol, see Ethyl mercaptan		
Ethanolamine	3	6
2-Ethoxyethanol-Skin	200	740
2-Ethoxyethylacetate (Cellosolve acetate)-Skin	100	540
Ethyl acetate	400	1,400
Ethyl acrylate-Skin	25	100
Ethyl alcohol (ethanol)	1,000	1,900
Ethylamine	10	18
Ethyl sec-amyl ketone (5-methyl-3-heptanone)	25	130
Ethyl benzene	100	435
Ethyl bromide	200	890
Ethyl butyl ketone (3-Heptanone)	50	230
Ethyl chloride	1,000	2,600
Ethyl ether	400	1,200
Ethyl formate	100	300
C Ethyl mercaptan	10	25
Ethyl silicate	100	850
Ethylene chlorohydrin-Skin	5	16
Ethylenediamine	10	25
Ethylene dibromide, see 1,2-Dibromoethane		
Ethylene dichloride, see 1,2-Dichloroethane		
C Ethylene glycol dinitrate and/or Nitroglycerin-Skin	0.2[3]	1
Ethylene glycol monomethyl ether acetate, see Methyl cellosolve acetate		
Ethylene imine-Skin	0.5	1
Ethylene oxide	50	90
Ethylidine chloride, see 1,1 Dichloroethane		
N-Ethylmorpholine-Skin	20	94
Ferbam		15
Ferrovanadium dust		1
Fluoride (as F)		2.5
Fluorine	0.1	0.2
Fluorotrichloromethane	1,000	5,600
Formic acid	5	9
Furfural-Skin	5	20
Furfural alcohol	50	200

See footnotes at end of table.

TABLE 48. (continued)

TABLE Z-1 (Cont.)

Substance	ppm[1/]	mg/m^3[2/]
Glycidol (2,3-Epoxy-1-propanol)	50	150
Glycol monoethyl ether, see 2-Ethoxyethanol		
Guthion®, see Azinphosmethyl		
Hafnium		0.5
Heptachlor-Skin		0.5
Heptane (n-heptane)	500	2,000
Hexachloroethane-Skin	1	10
Hexachloronaphthalene-Skin	0.2	
Hexane (n-hexane)	500	1,800
2-Hexanone	100	410
Hexone (Methyl isobutyl ketone)	100	410
sec-Hexyl acetate	50	300
Hydrazine-Skin	1	1.3
Hydrogen bromide	3	10
C Hydrogen chloride	5	7
Hydrogen cyanide-Skin	10	11
Hydrogen peroxide (90%)	1	1.4
Hydrogen selenide	0.05	0.2
Hydroquinone		2
C Iodine	0.1	1
Iron oxide fume		10
Isoamyl acetate	100	525
Isoamyl alcohol	100	360
Isobutyl acetate	150	700
Isobutyl alcohol	100	300
Isophorone	25	140
Isopropyl acetate	250	950
Isopropyl alcohol	400	980
Isopropylamine	5	12
Isopropylether	500	2,100
Isopropyl glycidyl ether (IGE)	50	240
Ketene	0.5	0.9
Lead arsenate		0.15
Lindane-Skin		0.5
Lithium hydride		0.025
L.P.G. (liquified petroleum gas)	1,000	1,800
Magnesium oxide fume		15
Malathion-Skin		15
Maleic anhydride	0.25	1
C Manganese		5
Mesityl oxide	25	100
Methanethiol, see Methyl mercaptan		

See footnotes at end of table.

TABLE 48. (continued)

TABLE Z-1 (cont.)

Substance	ppm[1/]	mg/m3[2/]
Methoxychlor		15
2-Methoxyethanol, see Methyl cellosolve		
Methyl acetate	200	610
Methyl acetylene (propyne)	1,000	1,650
Methyl acetylene-propadiene mixture (MAPP)	1,000	1,800
Methyl acrylate-Skin	10	35
Methylal (dimethoxymethane)	1,000	3,100
Methyl alcohol (methanol)	200	260
Methylamine	10	12
Methyl amyl alcohol, see Methyl isobutyl carbinol		
Methyl (n-amyl) ketone (2-Heptanone)	100	465
C Methyl bromide-Skin	20	80
Methyl butyl ketone, see 2-Hexanone		
Methyl cellosolve-Skin	25	80
Methyl cellosolve acetate-Skin	25	120
Methyl chloroform	350	1,900
Methylcyclohexane	500	2,000
Methylcyclohexanol	100	470
o-Methylcyclohexanone-Skin	100	460
Methyl ethyl ketone (MEK), see 2-Butanone		
Methyl formate	100	250
Methyl iodide-Skin	5	28
Methyl isobutyl carbinol-Skin	25	100
Methyl isobutyl ketone, see Hexone		
Methyl isocyanate-Skin	0.02	0.05
C Methyl mercaptan	10	20
Methyl methacrylate	100	410
Methyl propyl ketone, see 2-Pentanone		
C α Methyl styrene	100	480
C Methylene bisphenyl isocyanate (MDI)	0.02	0.2
Molybdenum:		
Soluble compounds		5
Insoluble compounds		15
Monomethyl aniline-Skin	2	9
C Monomethyl hydrazine-Skin	0.2	0.35
Morpholine-Skin	20	70
Naphtha (coaltar)	100	400
Naphthalene	10	50

See footnotes at end of table.

TABLE 48. (continued)

TABLE Z-1 (Cont.)

Substance	ppm[1/]	mg/m^3[2/]
Nickel carbonyl	0.001	0.007
Nickel, metal and soluble compounds, as Ni		1
Nicotine-Skin		0.5
Nitric acid	2	5
Nitric oxide	25	30
p-Nitroaniline-Skin	1	6
Nitrobenzene-Skin	1	5
p-Nitrochlorobenzene-Skin		1
Nitroethane	100	310
Nitrogen dioxide	5	9
Nitrogen trifluoride	10	29
Nitroglycerin-Skin	0.2	2
Nitromethane	100	250
1-Nitropropane	25	90
2-Nitropropane	25	90
Nitrotoluene-Skin	5	30
Nitrotrichloromethane, see Chloropicrin		
Octachloronaphthalene-Skin		0.1
Octane	500	2,350
Oil mist, mineral		5[4/]
Osmium tetroxide		0.002
Oxalic acid		1
Oxygen difluoride	0.05	0.1
Ozone	0.1	0.2
Paraquat-Skin		0.5
Parathion-Skin		0.11
Pentaborane	0.005	0.01
Pentachloronaphthalene-Skin		0.5
Pentachlorophenol-Skin		0.5
Pentane	1,000	2,950
2-Pentanone	200	700
Perchloromethyl mercaptan	0.1	0.8
Perchloryl fluoride	3	13.5
Petroleum distillates (naphtha)	500	2,000
Phenol-Skin	5	19
p-Phenylene diamine-Skin		0.1
Phenyl ether (vapor)	1	7
Phenyl ether-biphenyl mixture (vapor)	1	7
Phenylethylene, see Styrene (table Z-2)		
Phenylglycidyl ether (PGE)	10	60
Phenylhydrazine-Skin	5	22
Phosdrin (Mevinphos®)- Skin		0.1

See footnotes at end of table.

TABLE 48. (continued)

TABLE Z-1 (cont.)

Substance	ppm[1/]	mg/m^3[2/]
Phosgene (carbonyl chloride)	0.1	0.4
Phosphine	0.3	0.4
Phosphoric acid		1
Phosphorus (yellow)		0.1
Phosphorus pentachloride		1
Phosphorus pentasulfide		1
Phosphorus trichloride	0.5	3
Phthalic anhydride	2	12
Picric acid-Skin		0.1
Pival®(2-Pivalyl-1,3-indandione)		0.1
Platinum (Soluble salts) as Pt		0.002
Propane	1,000	1,800
Propargyl alcohol-Skin	1	
n-Propyl acetate	200	840
Propyl alcohol	200	500
n-Propyl nitrate	25	110
Propylene dichloride	75	350
Propylene imine-Skin	2	5
Propylene oxide	100	240
Propyne, see Methyl acetylene		
Pyrethrum		5
Pyridine	5	15
Quinone	0.1	0.4
RDX-Skin		1.5
Rhodium, metal fume and dusts, as Rh-		0.1
soluble salts		0.001
Ronnel		10
Rotenone (commercial)		5
Selenium compounds (as Se)		0.2
Selenium hexafluoride	0.05	0.4
Silver, metal and soluble compounds		0.01
Sodium fluoroacetate (1080)-Skin		0.05
Sodium hydroxide		2
Stibine	0.1	0.5
Stoddard solvent	500	2,950
Strychnine		0.15
Sulfur dioxide	5	13
Sulfur hexafluoride	1,000	6,000
Sulfuric acid		1
Sulfur monochloride	1	1
Sulfur pentafluoride	0.025	0.25
Sulfuryl fluoride	5	20

See footnotes at end of table.

TABLE 48. (continued)

TABLE Z-1 (cont.)

Substance	ppm[1/]	mg/m^3[2/]
Systox, see Demeton		
2,4,5T		10
Tantalum		5
TEDP-Skin		0.2
Tellurium		0.1
Tellurium hexafluoride	0.02	0.2
TEPP-Skin		0.05
C-Terphenyls	1	9
1,1,1,2-Tetrachloro-2,2-difluoroethane	500	4,170
1,1,2,2-Tetrachloro-1,2-difluoroethane	500	4,170
1,1,2,2-Tetrachloroethane-Skin	5	35
Tetrachloroethylene, see Perchloroethylene		
Tetrachloromethane, see Carbon tetrachloride (table Z-2)		
Tetrachloronaphthalene-Skin		2
Tetraethyl lead (as Pb)-Skin		0.075[5/]
Tetrahydrofuran	200	590
Tetramethyl lead (as Pb)-Skin		0.07[5/]
Tetramethyl succinonitrile-Skin	0.5	3
Tetranitromethane	1	8
Tetryl (2,4,6-trinitrophenyl-methylnitramine)-Skin		1.5
Thallium (soluble compounds)-Skin as Tl		0.1
Thiram		5
Tin (inorganic compounds, except oxides)		2
Tin (organic compounds)		0.1
Titanium dioxide		15
C Toluene-2,4-diisocyanate	0.02	0.14
o-Toluidine-Skin	5	22
Toxaphene, see Chlorinated camphene		
Tributyl phosphate		5
1,1,1-Trichloroethane, see Methyl chloroform		
1,1,2-Trichloromethane-Skin	10	45
Trichloromethane, see Chloroform		
Trichloronaphthalene-Skin		5
1,2,3-Trichloropropane	50	300
1,1,2-Trichloro 1,2,2-trifluoroethane	1,000	7,600
Triethylamine	25	100
Trifluoromonobromomethane	1,000	6,100
2,4,6-Trinitrophenol, see Picric acid		
2,4,6-Trinitrophenylmethylnitramine, see Tetryl		

See footnotes at end of table.

TABLE 48. (continued)

TABLE Z-1 (cont.)

Substance	ppm[1/]	mg/m^3[2/]
Trinitrotoluene-Skin		1.5
Triorthocresyl phosphate		0.1
Triphenyl phosphate		3
Turpentine	100	560
Uranium (soluble compounds)		0.05
Uranium (insoluble compounds)		0.25
C Vanadium:		
V_2O_5 dust		0.5
V_2O_5 fume		0.1
Vinyl benzene, see Stryene (table Z-2)		
Vinylcyanide, see Acrylonitrile		
Vinyl toluene	100	480
Warfarin		0.1
Xylene (xylol)	100	435
Xylidine-Skin	5	25
Yttrium		1
Zinc chloride fume		1
Zinc oxide fume		5
Zirconium compounds (as Zr)		5

[1] Parts of vapor or gas per million parts of contaminated air by volume at 25° C and 760 mm Hg pressure.

[2] Approximate milligrams of particulate per cubic meter of air.

[3] An atmospheric concentration of not more than 0.02 ppm or personal protection may be necessary to avoid headache.

[4] As sampled by method that does not collect vapor.

[5] For control of general room air, biologic monitoring is essential for personnel control.

TABLE 48. (continued)

TABLE Z-2

<table>
<tr><th rowspan="2">Material</th><th rowspan="2">8-hour time weighted average</th><th rowspan="2">Acceptable ceiling concentration</th><th colspan="2">Acceptable maximum peak above the acceptable ceiling concentration for an 8-hour shift</th></tr>
<tr><th>Concentration</th><th>Maximum duration</th></tr>
<tr><td>Benzene (Z37.4-1969)</td><td>10 ppm</td><td>25 ppm</td><td>50 ppm</td><td>10 minutes</td></tr>
<tr><td>Beryllium and beryllium compounds (Z37.29-1970)</td><td>2 μg/</td><td>5 μg/</td><td>25 μg</td><td>30 minutes</td></tr>
<tr><td>Cadmium fume (Z37.5-1970)</td><td>0.1 mg/</td><td>0.6 mg/</td><td></td><td></td></tr>
<tr><td>Cadmium dust (Z37.5-1970)</td><td>0.2 mg/</td><td></td><td></td><td></td></tr>
<tr><td>Carbon disulfide (Z37.3-1968)</td><td>20 ppm</td><td>30 ppm</td><td></td><td>do</td></tr>
<tr><td>Carbon tetrachloride (Z37.17-1967)</td><td>10 ppm</td><td>25 ppm</td><td>200 ppm</td><td>5 minutes in any 4 hours</td></tr>
<tr><td>Ethylene dibromide (Z37.31-1970)</td><td>20 ppm</td><td>30 ppm</td><td>50 ppm</td><td>5 minutes</td></tr>
<tr><td>Ethylene dichloride (Z37.21-1969)</td><td>50 ppm</td><td>100 ppm</td><td>200 ppm</td><td>5 minutes in any 3 hours</td></tr>
<tr><td>Formaldehyde (Z37.16-1967)</td><td>3 ppm</td><td>5 ppm</td><td>10 ppm</td><td>30 minutes</td></tr>
<tr><td>Hydrogen fluoride (Z37.28-1969)</td><td>do</td><td></td><td></td><td></td></tr>
<tr><td>Fluoride as dust (Z37.28-1969)</td><td>2.5 mg/</td><td></td><td></td><td></td></tr>
<tr><td>Lead and its inorganic compounds (Z37.11-1969)</td><td>0.2 mg/</td><td></td><td></td><td></td></tr>
<tr><td>Methyl chloride (Z37.18-1969)</td><td>100 ppm</td><td>200 ppm</td><td>300 ppm</td><td>5 minutes in any 3 hours</td></tr>
<tr><td>Methylene chloride (Z37.3-1969)</td><td>500 ppm</td><td>1,000 ppm</td><td>2,000 ppm</td><td>5 minutes in any 2 hours</td></tr>
<tr><td>Organo (alkyl) mercury (Z37.30-1969)</td><td>0.01 mg/</td><td>0.04 mg/</td><td></td><td></td></tr>
<tr><td>Styrene (Z37.15-1969)</td><td>100 ppm</td><td>200 ppm</td><td>600 ppm</td><td>5 minutes in any 3 hours</td></tr>
<tr><td>Trichloroethylene (Z37.19-1967)</td><td>do</td><td>do</td><td>300 ppm</td><td>5 minutes in any 2 hours</td></tr>
<tr><td>Tetrachloroethylene (Z37.22-1967)</td><td>do</td><td>do</td><td>do</td><td>5 minutes in any 3 hours</td></tr>
<tr><td>Toluene (Z37.12-1967)</td><td>200 ppm</td><td>300 ppm</td><td>500 ppm</td><td>10 minutes</td></tr>
<tr><td>Hydrogen sulfide (Z37.2-1966)</td><td></td><td>20 ppm</td><td>50 ppm</td><td>10 minutes once only if no other measurable exposure occurs.</td></tr>
<tr><td>Mercury (Z37.8-1971)</td><td></td><td>1 mg/10</td><td></td><td></td></tr>
<tr><td>Chromic acid and chromates (Z37.7-1971)</td><td></td><td>do</td><td></td><td></td></tr>
</table>

TABLE 48. (Continued)

TABLE Z-3

Substance	mppcf[1]	mg/m^3
Silica:		
Crystalline:		
Quartz (respirable)	$\frac{250}{\%SiO_2+5}$[2]	$\frac{10mg/M^3}{\%SiO_2+2}$[3]
Quartz (total dust)		$\frac{30mg/M^3}{\%S_2O_2+2}$
Cristobalite: Use ½ the value calculated from the count or mass formulae for quartz.		
Tridymite: Use ½ the value calculated from the formulae for quartz.		
Amorphous, including natural diatomaceous earth	20	$\frac{80mg/M^3}{\%SiO_2}$
Silicates (less than 1% crystalline silica):		
Mica	20	
Soapstone	20	
Talc (non-asbestos form)	20[4]	
Talc (fibrous). Use asbestos limit		
Tremolite (see talc, fibrous)		
Portland cement	50	
Graphite (natural)	15	
Coal dust (respirable fraction less than 5% SiO_2)		2.4mg/M^3 or
For more than 5% SiO_2		$\frac{10mg/M^3}{\%SiO_2+2}$
Inert or Nuisance Dust:		
Respirable fraction	15	5mg/M^3
Total dust	50	15mg/M^3

See footnotes on next page.

TABLE 48. (continued)

Footnotes for Table Z-3

[1] Millions of particles per cubic foot of air, based on impinger samples counted by light-field technics.

[2] The percentage of crystalline silica in the formula is the amount determined from air-borne samples, except in those instances in which other methods have been shown to be applicable.

[3] Both concentration and percent quartz for the application of this limit are to be determined from the fraction passing a size-selector with the following characteristics:

Aerodynamic diameter (unit density sphere)	Percent passing selector
2	90
2.5	75
3.5	60
5.0	25
10	0

The measurements under this note refer to the use of an AEC instrument. If the respirable fraction of coal dust is determined with an MRE, the figure corresponding to that of 2.4 Mg/M^3 in the table for coal dust is 4.5 Mg/M^3. [39 FR 23502, June 27, 1974. Redesignated and amended at 40 FR 23073, May 28, 1975.]

[4] Containing <1% quartz; if >1% quartz, use quartz limit.

TABLE 49. OSHA STANDARDS ESTABLISHING WORKPLACE AIR CONTAMINANT LEVELS[a] (adopted or proposed since 1972).

Contaminant	Standard	Ceiling
Asbestos	2 fibers/cc air	10 fibers/cc
Coke oven emissions	150 ug/m^3 - 8-hour day	---
Cotton Dust		
Slashing and weaving	750 ug/m^3 - 8-hour day	
Others	500 ug/m^3 - 8-hour	
1,2,-Dibromo-3-chloropropane	1 ppb 8-hour day	---
Vinyl Chloride	1 ppm 8-hour day	5 ppm
Benzene[b]	1 ppm	5 ppm
Acrylonitrile	2 ppm TWA	10 ppm
Carcinogens (14)[c]		
Lead	50 μg/m^3	

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[a] Regulations for these contaminants also include rules covering personal protective equipment, work practices, environmental monitoring, medical surveillance, record keeping, etc.

[b] Revoked by court action.

[c] See Table 53.

TABLE 50. SUBSTANCES REGULATED BY OSHA AS CARCINOGENS

2-Acetylamino fluorine
Acrylonitrile
4-Aminodiphenyl
Asbestos
Benzene
Benzidine
bis-Chloromethyl ether
Coke oven emissions
3,3-Dichlorobenzidine (and its salts)
4-Dimethylaminoazobenzene
Ethyleneimine
Methyl chloromethyl ether
α-Naththylamine
β-Naphthylamine
4-Nitrobiphenyl
n-Nitrosodimethylamine
β-Propiolactone
Vinyl chloride

TABLE 51. PRELIMINARY LIST OF OSHA CATEGORY I CONFIRMED CARCINOGENS PRODUCED IN SIGNIFICANT QUANTITIES

Organic Substances

Acetamide (60-35-5)[b]; Acetic acid, Chromium (3+) salt (1066-30-4); Acetic acid, Lead (2+) salt (301-04-2); Ammonium, (4-(p-Dimethylamino)-alpha-(p-ethyl-m-sulfobenzyl)amino)phenylbenzylidene-2,5-cyclohexadien-1-ylidene)ethyl(m-sulfobenzyl)-, hydroxide, inner salt, sodium salt (1694-09-3); Aniline, N,N-Dimethyl-p-(phenylazo)- (60-11-7); Aniline, 4,4'-(Imidocarbonyl)bis(N,N-dimethyl- (492-80-8); Aniline, 4,4'-(Imidocarbonyl)bis(N,N-dimethyl-hydrochloride (2465-27-2); Aniline, p-(Phenylazo)- (60-09-3);

Barbituric Acid, 5-Ethyl-5-phenyl-, Sodium salt (57-30-7); Benz(a)anthracene, 7,12-Dimethyl- (57-97-6); Benzenamine, 4,4'-Methylenebis(2-chloro- (101-14-4); Benzene (71-43-2); Benzene, 4-Allyl-1,2-(methylenedioxy)- (94-59-7); Benzene, 1,2-Methylenedioxy-4-propyl- (94-58-6); Benzidine (92-87-5); Benzidine, 3,3'-Dichloro- (91-94-1); Benzidine, 3,3'-Dimethoxy- (119-90-4); Benzidine Sulfate (531-86-2); 1,2-Benzisothiazolin-3-one, 1,1-dioxide (81-07-2); 1,2-Benzisothiazolin-3-one, 1,1-dioxide, Sodium salt (128-44-9); Butyric Acid, 4-(p-Bis(2-chloroethyl)aminophenyl)- (305-03-3);

Cadmium, Bis(diethyldithiocarbamato)- (14239-68-0); Carbamic acid, ethyl ester (51-79-6); Carbon tetrachloride (56-23-5); Chloroform (67-66-3); Cholanthrene, 3-Methyl- (56-49-5); Coumarin (91-64-5); Cyclohexane, 1,2,3.4,5,6-Hexachloro-, gamma-isomer (58-89-9); 1,4:5,8-Dimethanonaphthalene, 1,2,3,4,10,10-Hexachloro-6,7-epoxy-1,4,4a,5,6,7,8,8a-octahydro, endo, exo- (60-57-1); Dimethylamine, N-Nitroso- (62-75-9); p-Dioxane (123-91-1);

Ethane, 1,2-Dibromo- (106-93-4); Ethane, 1,1,1-Trichloro-2,2-bis(p-chlorophenyl)- (50-29-3); Ethylene, Chloro-, monomer (75-01-4); Ethylene, Trichloro- (79-01-6); Ethylenimine (151-56-4); Formic Acid, 2-(4-(5-Nitro-2-furyl)-2-thiazolyl)-, Hydrazide (3570-75-0); Hydrazine, Phenyl-, Hydrochloride (59-88-1); Isonicotinic acid hydrazide (54-85-3); Lead, Bis (acetato)tetrahydroxytri- (1335-32-6); Lead Naphthenate (61790-14-5);

1,3,4-Metheno-1H-cyclobuta(cd)pentalene, 1,1a,2,2,3,3a,4,5,5a,5b,6-Dodecachloro-octahydro- (2385-85-5); 1,3,4-Metheno-2H-cyclobuta(cd)pentalene-2-one,1,1a,3,3a,4,5,5a,5b,6-Decachlorooctahydro- (143-50-0); 2,7-Naphthalenedisulfonic Acid, 3,3'-((3,3'-Dimethyl-4,4'-biphenylene)-bis(azo))bis-(5-amino-4-hydroxy-, Tetrasodium salt (72-57-1); 2,7-Naphthalenedisulfonic Acid, 3-Hydroxy-4-((2,4,5-trimethylphenyl)azo)-, Disodium salt (3564-09-8); 2,7-Naphthalenedisulfonic Acid, 3-Hydroxy-4-(2,4-xylylazo)-, Disodium salt (3761-53-3); 2-Naphthol, 1-((2,5-Dimethoxyphenyl)azo)- (6358-53-8); 2-Naphthol, 1-(o-Tolylazo)- (2646-17-5); 1-Naphthylamine (134-32-7); 2-Naphthylamine (91-59-8); Nickel (II) acetate (1:2) (373-02-4); Nickel, Bis (dibutyldithiocarbamato)- (13927-77-0); 19-nor-17-alpha-Pregn-5(10)-en-20-yn-3-one, 17-Hydroxy- (68-23-5);

Oxetanone (57-57-8); Polyethylene glycol monostearate (90004-99-3); Progesterone (57-83-0); Propane, 1,2-Dibromo-3-chloro- (96-12-8); Pyridine, 2,6-Diamino-3-(phenylazo)-, Monohydrochloride (136-40-3); 4,4'-Stilbenediol, alpha, alpha-Diethyl- (56-53-1); Sulfuric acid, Dimethyl ester (77-78-1); Sulfurous acid, 2-(p-t-Butylphenoxy)-1-methyl-ethyl-2-chloroethyl-ester (140-57-8); Tannic Acid (1401-55-4); Thioacetamide (62-55-5); o-Toluidine (95-53-4);

4-Toluidine, alpha-(p-Aminophenyl)-alpha-(4-imino-2,5-cyclohexadien-1-ylidene)-, Monohydrochloride (569-61-9); s-Triazole, 3-Amino- (61-82-5); Uracil, 6-Propyl-2-thio- (51-52-5); Uracil, 2-Thio- (141-90-2); 2,4-Xylidene, alpha(sup 4)-p-Aminophenyl)-alpha (sup 4)-(4-imino-2,5-cyclohexadien-1-ylidene (3248-93-9); 2,4-Xylidene, alpha(sup 4)-(p-Aminophenyl)-alpha-(sup4)-(4-imino-2,5,cyclohexadien-1-ylidene)-, Monohydrochloride (632-99-5).

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[b] Chemical Abstract Service Numbers

TABLE 51. (Continued)

Inorganic Substances

Amosite (12172-73-5); Anthophylite (17068-78-9); Arsenic (7440-38-2); Arsenic Acid, Calcium salt (2:3) (10103-62-5); Arsenious Acid, Disodium salt (15120-17-9); Arsenic Acid, Lead(2+)salt(1:1) (7784-40-9); Arsenious Acid, Potassium salt (10124-50-2); Arsenic Trioxide (1327-53-3); Asbestos (1332-21-4);

Bertrandite (1318-19-0); Beryl (1302-52-9); Beryllium (7440-41-7); Beryllium hydrogen phosphate (13598-15-7); Beryllium oxide (1304-56-9); Beryllium sulfate (1:1) (13510-49-1); Beryllium sulfate tetrahydrate(1:1:4) (7787-56-6);

Cadmium (7440-43-9); Cadmium chloride (10108-64-2); Cadmium oxide (1306-19-0); Cadmium sulfate (1:1) (10124-36-4); Cadmium sulfate, Tetrahydrate (13477-21-9); Cadmium sulfide (1306-23-6); Chromic Acid, Calcium salt(1:1) (13765-19-0); Chromic Acid, Calcium salt(1:1), dihydrate (10060-08-0);

Chromic Acid, Chromium(3+) salt (3:2) (24613-89-6); Chromic Acid, Dipotassium salt (7789-00-6); Chromic Acid, Disodium salt (7775-11-3); Chromic Acid, Lead (2+) salt (1:1) (7758-97-6); Chromite (1308-31-2); Chromium (7440-47-3); Chromium Chromate (41261-95-4); Chromium(III)oxide(2:3) (1308-38-9); Chromium(VI)oxide(1:3) (1333-82-0); Chrysotile (12001-29-5); Crocidolite (12001-28-4);

Dichromic Acid, Disodium salt (10588-01-9); Hematite (1317-60-8); Hydrazine (302-01-2); Lead Chromate(VI)oxide (1344-38-3); Lead(II)phosphate(3:2) (7446-27-7); Nickel (7440-02-0); Nickel Carbonyl (13463-39-3); Nickel(II)oxide (1313-99-1); Nickel Refinery Dust; Nickel sulfide(3:2) (12035-72-2); Serpentine (14567-66-9).

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[a] Toxic Materials News, Business Publishers, Inc., July 19, 1978, p. 207, 208.

TABLE 52. SUMMARY OF NIOSH RECOMMENDATIONS FOR OCCUPATIONAL HEALTH STANDARDS

Substance	Transmitted to OSHA	Current OSHA Environmental Standard*	NIOSH Recommendation for Environmental Exposure Limit*
Acetylene	July 1, 1976	2,500-ppm (10% of lower explosive limit)	No exposure in excess of 2,500-ppm
Acrylamide	October 21, 1976	0.3 mg/cu m, 8-hr TWA "skin"	0.3 mg/cu m TWA
Alkanes (C5-C8)	March 29, 1977	Pentane: 1000 ppm, 8-hr TWA. 8-hexane, 8-heptane, octane: 500 ppm, 8-hr TWA	350 mg/cu m TWA; Mixtures to be not greater than 350 mg/cu m TWA; 1800 mg/cu m ceiling singly or mixtures (15-minute)
Allyl chloride	September 21, 1976	1-ppm, 8-hr TWA	1-ppm TWA; 3-ppm ceiling (15-minute)
Allyl glycidyl ether	July 1978	45 mg/cu m, ceiling	45 mg/cu m ceiling (15-minute)
Ammonia	July 15, 1974	50-ppm; 8-hr TWA	50-ppm ceiling (5-minute)
Arsenic Inorganic	January 21, 1974 Revised: June 23, 1975	10µg As/cu m TWA	2 µg As/cu m ceiling (15-minute)
Asbestos	January 21, 1972 Revised: December 15, 1976	2,000,000 fibers/cu m 8-hr TWA; 10,000,000 fibers/cu m ceiling	100,000 fibers/cu m over 5 microns TWA; 500,000 fibers/cu m over 5 microns ceiling; (15-minute)
Benzene	July 24, 1974 Revised: August 20, 1976	1-ppm, 8-hr TWA; 5-ppm maximum	1-ppm ceiling (120-minute)
Benzyl chloride	August 1978	5 mg/cu m TWA	5 mg/cu m ceiling (15-min)
Benzoyl peroxide	June 7, 1977	5 mg/cu m, 8-hr TWA	5 mg/cu m TWA
Beryllium	June 30, 1972 Revised: December 10, 1975	2 µg/cu m, 8-hr TWA 5 µg/cu m acceptable ceiling; 25 µg/cu m maximum ceiling (30-minute)	2 µg/cu m TWA 25 µg/cu m ceiling (30-minute)
Boron Trifluoride	December 15, 1976	1-ppm ceiling	None recommended
n-Butyl glycidyl ether	July 1978	270 mg/cu m TWA	30 mg/cu m ceiling (15-min)
Cadmium	August 23, 1976	0.1 mg/cu m, 8-hr TWA; 0.3 mg/cu m ceiling (fume: erroneously published as 3 mg/cu m) 0.2 mg/cu m, 8-hr TWA; 0.6 mg/cu m ceiling (dust)	40 µg Cd/cu m TWA; 200 µg Cd/cu m ceiling (15-minute)
Carbaryl	September 30, 1976	5 mg/cu m, 8-hr TWA	5 mg/cu m TWA
Carbon dioxide	August 11, 1976	5,000-ppm, 8-hr TWA	10,000-ppm TWA; 30,000-ppm ceiling (10-minute)
Carbon disulfide	May 4, 1977	20-ppm, 8-hr TWA; 30-ppm acceptable ceiling; 100-ppm maximum ceiling	1-ppm TWA; 10-ppm ceiling (15-minute)
Carbon monoxide	August 3, 1972	50-ppm, 8-hr TWA	35-ppm TWA; 200-ppm ceiling
Carbon tetrachloride	December 22, 1975 Revised: June 9, 1976	10-ppm, 8-hr TWA; 25-ppm acceptable ceiling; 200-ppm maximum ceiling (5-minute in 4 hours)	2-ppm ceiling (60-minute)
Chlorine	May 25, 1976	1-ppm, 8-hr TWA	0.5-ppm ceiling (15-minute)
Chloroform	September 11, 1974 Revised: June 9, 1976	50-ppm ceiling	2-ppm ceiling (60-minute)

*NIOSH TWA recommendations based on up to a 10 hour exposure unless otherwise noted.

TABLE 52. (continued)

Substance	Transmitted to OSHA	Current OSHA Environmental Standard*	NIOSH Recommendation for Environmental Exposure Limit*
Chromic acid	July 17, 1973	1 mg/10 cu m ceiling	0.05 mg CrO3/cu m TWA 0.1 mg CrO3/cu m ceiling (15-min)
Chromium (VI)	December 1, 1975	100 μg/10 cu m ceiling	1 μg/cu m for carcinogenic Cr (VI); 25 μg/cu m TWA for other Cr (VI); 50 μg/cu m ceiling (15-minute)
Coke oven emissions	February 28, 1973	0.15 mg/cu m (coal tar pitch volatiles)	Work practices to minimize exposure to emissions
Cotton dust	September 26, 1974	750 μg/cu m 8-hr slashing and weaving; 500 μg/cu m other processes 8-hr	Lowest feasible limit
Cresol		22 mg/cu m TWA	10 mg/cu m TWA
Cyanide, hydrogen and cyanide salts	October 4, 1976 (HCN); 5 mg CN/cu m	10-ppm, 8-hr TWA (alkali cyanides)	5 mg CN/cu m ceiling (10-minute)
Cyclohexanone		200 mg/cu m TWA	100 mg/cu m TWA
Diacetone alcohol		240 mg/cu m TWA	240 mg/cu m TWA
Diglycidyl ether		2.8 mg/cu m TWA	1 mg/cu m TWA
Diisobutyl ketone		290 mg/cu m TWA	140 mg/cu m TWA
1,1-Dimethyl hydrazine			0.15 mg/cu m (2-hr)
Epichlorohydrin	September 17, 1976	5-ppm, 8-hr TWA 20 mg/cu m	2 mg/cu m TWA; 19 mg/cu m ceiling (15-minute)
Ethylene glycol dinitrate or nitro glycerine	July 1978	1 mg/cu m ceiling	0.1 mg/cu m ceiling (20-minute)
Ethylene dichloride	March 9, 1976	50-ppm, 8-hr TWA, 100-ppm acceptable ceiling; 200-ppm maximum ceiling (5-minutes in 3 hours)	5-ppm TWA, 15-ppm ceiling (15-minute)
Fibrous glass	April 15, 1977	15 mg/cu m total dust; 5 mg/cu m respirable fraction (nuisance dust)	3,000,000 fibers/cu m TWA (fibers < 3.5 microns diameter and >10 microns length); 5 mg/cu m TWA (total fibrous glass)
Fluorides, inorganic	June 30, 1975	2.5 mg/cu m, 8-hr TWA	2.5 mg F/cu m TWA
Formaldehyde	December 30, 1976	3-ppm, 8-hr TWA; 5-ppm acceptable ceiling; 10-ppm maximum ceiling (30-minute)	1.2 mg/cu m ceiling (30-minute)
Hot environments	June 30, 1972	None	Variable (sliding scale)
Hydrogen fluoride	March 9, 1976	3-ppm, 8-hr TWA	2.5 mg F/cu m TWA; 5.0 mg/cu m ceiling (15-minute, fluoride ion)
Hydrogen sulfide	May 4, 1977	20-ppm acceptable ceiling; 50-ppm maximum ceiling (10-minute)	15 mg/cu m ceiling (10-minute)
Hydroquinone	April 1978	2 mg/cu m 8-hr TWA	2 mg/cu m ceiling (15-minute)
Isophorone		140 mg/cu m TWA	23 mg/cu m TWA
Isopropyl alcohol	March 9, 1976	400-ppm, 8-hr TWA	400-ppm TWA, 800-ppm ceiling (15-minute)
Isopropyl glycidyl ether		240 mg/cu m TWA	240 mg/cu m ceiling (15-min)
Kepone	January 27, 1976	None	1 μg/cu m ceiling (15-minute)
Lead, inorganic	January 5, 1973 Revised: August 4, 1975	0.2 mg/cu m, 8-hr TWA	0.05-0.15 mg/cu m 8 hr
Malathion	July 1, 1976	15 mg/cu m, 8-hr TWA	15 mg/cu m TWA
Mercury, inorganic	January 5, 1973	0.1 mg/cu m ceiling	0.05 mg/cu m TWA

TABLE 52. (continued)

Substance	Transmitted to OSHA	Current OSHA Environmental Standard*	NIOSH Recommendation for Environmental Exposure Limit*
Mesityl oxide		100 mg/cu m TWA	40 mg/cu m TWA
Methyl alcohol	March 22, 1976	200-ppm TWA; 500-ppm ceiling	200-ppm TWA; 500-ppm ceiling (15-minute)
Methyl n-amyl ketone		465 mg/cu m TWA	465 mg/cu m TWA
Methyl n-butyl ketone		410 mg/cu m TWA	4 mg/cu m TWA
Methyl ethyl ketone		590 mg/cu m TWA	590 mg/cu m TWA
Methyl hydrazine	June 1978	None	0.15 mg/cu m (2-hr)
Methyl isoamyl ketone		None	140 mg/cu m TWA
Methyl isobutyl ketone		410 mg/cu m TWA	200 mg/cu m TWA
Methyl parathion	September 30, 1976	None	0.2 mg/cu m TWA
Methyl n-propyl ketone		700 mg/cu m TWA	590 mg/cu m TWA
Methylene chloride	March 9, 1976	500-ppm, 8-hr TWA; 1000-ppm acceptable ceiling; 2000-ppm maximum (5-minutes in 2-hrs)	75-ppm TWA; 500-ppm ceiling, (15-minute). TWA to be lowered in presence of carbon monoxide.
Nickel, inorganic and compounds	May 13, 1977	1 mg/cu m, 8-hr TWA	15 ug Ni/cu m TWA
Nitric acid	March 9, 1976	2-ppm, 8-hr TWA	2-ppm TWA
Nitrogen, oxides	March 22, 1976	NO2: 5-ppm, 8-hr TWA NO:25 ppm 8 hr TWA	NO2: 1-ppm ceiling NO: 25 ppm TWA
Noise	August 10, 1972	90 dBA, 8-hr TWA	85 dBA TWA; 115 dBA ceiling
Organotin compounds	November 12, 1976	0.1 mg tin/cu m 8-hr TWA	0.1 mg tin/cu m TWA
Parathion	June 30, 1976	0.1 mg/cu m TWA	0.05 mg/cu m TWA
Phenol	June 30, 1976	5-ppm, 8-hr TWA skin	20 mg/cu m TWA; 60 mg/cu m ceiling (15-minute)
Phenylhydrazine	June 1978		0.6 mg/cu m (2-hr)
Phosgene	February 23, 1976	0.1-ppm, 8-hr TWA	0.1-ppm TWA; 0.2-ppm ceiling (15-minute)
Silica, crystalline	November 11, 1974	250%S10 + 5 in mppcf, or 10 mg/cu m/%S10 + 2 (respirable quartz)	50 ug/cu m TWA, respirable free silica
Sodium hydroxide	September 16, 1975	2 mg/cu m, 8-hr TWA	2 mg/cu m ceiling (15-minute)
Sulfur dioxide	February 11, 1974 Revised: May 12, 1977	5-ppm, 8-hr TWA	0.5-ppm TWA
Sulfuric acid	June 6, 1974	1 mg/cu m, 8-hr TWA	1 mg/cu m TWA
1,1,2,2-Tetrachlorethane	December 17, 1976	5-ppm; 5-hr TWA "skin"	1-ppm TWA
Tetrachloroethylene	July 2, 1976	100-ppm, 8-hr TWA; 200-ppm acceptable maximum ceiling; 300-ppm maximum ceiling (5-minutes in 3 hours)	50-ppm TWA; 100-ppm ceiling (15-minute)
o-Folidine	-	-	20 ug/cu m ceiling (1-hr)
Toluene	July 23, 1973	200-ppm, 8-hr TWA; 300-ppm acceptable ceiling; 500-ppm maximum ceiling (10-minute)	100-ppm TWA; 200-ppm ceiling (10-minute)
Toluene diisocyanate	July 13, 1973	0.02-ppm ceiling	0.005-ppm TWA; 0.02 ceiling (20-minute)
1,1,1.-Trichloroethane	July 2, 1976	350-ppm, 8-hr TWA	350-ppm ceiling (15-minute)
Trichloroethylene	July 23, 1973	100-ppm, 8-hr TWA; 200-ppm acceptable ceiling; 300-ppm maximum ceiling; (5-minutes in any 2 hours)	100-ppm TWA; 150-ppm ceiling (10-minute)

TABLE 52. (continued)

Substance	Transmitted to OSHA	Current OSHA Environmental Standard*	NIOSH Recommendation for Environmental Exposure Limit*
Ultraviolet radiation	December 20, 1972	10 mW/cm averaged over any 1-hour period	1.0 mW/cm for over 1000 sec.; 100 mW sec/cm for periods under 1000 sec.
Vinyl chloride	March 11, 1974	1-ppm, 8-hr TWA; 5-ppm ceiling, (15-minute sample)	Minimum Detectable level; 1-ppm ceiling (15-minute)
Waste anesthetic gases and vapors	March 4, 1977	None for substances when used as anesthetic agents	2-ppm ceiling (halogenated anesthetic agents) (1-hour); 25-ppm TWA during periods of use (nitrous oxide)
Xylene	May 23, 1975	100-ppm, 8-hr TWA	100-ppm TWA; 200-ppm ceiling (10-minute)
Zinc oxide	October 10, 1975	5 mg/cu m, 8-hr TWA	5 mg/cu m TWA, 15 mg/cu m ceiling (15-minute)
ADDITIONAL SUBSTANCES:			
Asphalt fumes	September 1977	-	5 mg/cu m; 15 min period
Coal tar products	September 1977	0.2	0.1 mg/cu m TWA
Dinitro-ortho-cresol	February 1978	0.2 mg/cu m	0.2 mg/cu m TWA
Tungsten	September 1977	-	5 mg/cu m TWA
Polychlorinated biphenyls (PCBs)	September 1977	-	1.0 ug/cu m TWA
Refined petroleum solvents	July 1977	-	350 mg/cu m TWA
Decomposition products of fluorocarbon polymers	September 1977	-	No recommendation
Ethylene dibromide	August 1977	30 ppm ceiling 25 ppm TWA	1.0 mg/cu m; 0.13 ppm ceiling (15 min)
Dioxone	September 1977	100 ppm 360 mg/cu m	1 ppm (3.6 mg/cu m) 30 min ceiling
Chloroprene	August 1977	25 ppm 90 mg/cu m	3.6 mg/cu m; 1 ppm ceiling (15 min)
Acetone	July 1978	2400 mg/cu m TWA	590 mg/cu m TWA
Vanadium (Compounds) Metallic and vanadium carbide	August 16, 1977		0.05 mg/cu m; 15 min ceiling 1.0 mg/cu m TWA

TABLE 53. CHEMICALS, PHYSICAL AGENTS, AND PROCESSES TO BE ADDRESSED BY NIOSH IN 1979-1980

Aliphatic Di and polyamines
Aromatic amines
Brominated aliphatics
Dichloropropane
Diesel emissions
Diphenyl
Dyeing and finishing textiles
Hexachlorobutadiene
Hexachloroethane
Hydrogen chloride
Infrared radiation
Manufacture of N-metal pigments and dyes
Monochloroacetic acid
Monochloroethane
Plastics and resins manufacture
Pentachloroethane
Pulp and paper mills
Secondary aliphatic monoamines
Terphenyl
Tertiary aliphatic monoamines
Tetrahydrofuran
Trichloropropane
Ultrasonics
Vibration, whole body
Wood preserving

TABLE 54. COMPOUNDS KNOWN TO BE PRESENT IN COAL GASIFICATION PROCESSES AND WHICH HAVE OCCUPATIONAL STANDARDS

Compound	Where found
Acetic acid	Gas stream
Acetone	Laboratory
Ammonia	Gas stream
Aniline-skin	
Antimony	Trace element in coal
Arsenic	Trace element in coal
Benzene	Gas stream, laboratory
Beryllium	Trace element in coal
1,3-Butadiene	Gas stream
Cadmium fume dust	Trace element in coal
Carbon dioxide	Gas stream
Carbon disulfide	Gas stream
Carbon monoxide	Gas stream
Carbon tetrachloride	Laboratory
Chromium, soluble salts	
Metal, insoluble salts	Trace element in coal
Coal dust (<5% SiO_2)	Coal preparation areas
(>5% SiO_2)	
Coal tar pitch volatiles	Gas stream
Cresol-skin	Gas stream
Ethyl mercaptan	Gas stream
Hydrogen chloride	Stream
Hydrogen sulfide	Gas stream
Lead and inorganic lead compounds	Trace element in coal
Manganese	Trace element in coal
Mercury	Trace element in coal
Methyl ethyl ketone	Laboratory
Methyl mercaptan	Gas stream
Naphtha (coal tar)	Gas stream
Naphthalene	Gas stream
Nickel carbonyl	Methanation areas
Nickel metal and soluble compounds (as Ni)	Trace element in coal
Phenol-skin	Gas and effluent stream
Propane	Gas stream
Pyridine	Gas stream
Selenium compounds	Trace element in coal
Silica (respirable)	
(total dust)	
Styrene	
Sulfur dioxide	Thermal oxidizer
Toluene	Slurry oil, gas stream
Vanadium	Trace element in coal
V_2O_5 dust	
V_2O_5 fume	
Xylene	Gas stream

[a] As listed in NIOSH document entitled "Recommended Health and Safety Guidelines for Coal Gasification Pilot Plants."

TABLE 55. COMPOUNDS SUSPECTED TO BE PRESENT IN COAL GASIFICATION PROCESSES AND FOR WHICH OCCUPATIONAL STANDARDS EXIST*

Butyl mercaptan
Calcium arsenate
Cyclohexane
Cyclohexanol
Cyclohexene
Cyclopentadiene
Dimethylamine
Dimethylsulfate - skin
Dinitrobenzene - skin
Dinitro-o-cresol - skin
Dinitrotoluene - skin
Diphenyl
Ethanol
Ethanolamine
2-Ethoxyethanol - skin
Ethyl acetate
Ethylamine
Ethyl benzene
n-Heptane
n-Hexane
Isobutyl acetate
Methyl acetate
Methyl alcohol
Methylamine
Nitrobenzene - skin
Nitrogen dioxide
Octane
Oil mist, mineral
Pentane
Petroleum distillates
Phosphorus compounds
Picric acid - skin
n-Propyl acetate
Propyl alcohol
Sodium hydroxide
Tellurium

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*As listed in NIOSH document "Recommended Health and Safety Guidelines for Coal Gasification Pilot Plants."

TABLE 56. 1977 ACGIH TLV^R RECOMMENDATIONS NOT INCLUDED IN 1968 LIST

	ADOPTED VALUES TWA	
Substance	ppm^a	mg/m$^{3\,b)}$
Argon	9	----
Asbestos (all forms)	----	a
Asphalt (petroleum) fumes	----	5
Baygon (propoxur)	----	0.5
Benzene - Skin	10,A2	30,c
Benzidine		
production - Skin	----	b
Benz(a)pyrene	----	e
Beryllium	----	0.002
Bismuth telluride	----	10
Bismuth telluride, Se-doped	----	5
Borates, tetra, sodium salts,		
Anhydrous	----	1
Decahydrate	----	5
Pentahydrate	----	1
Boron tribromide	1	10
Bromine pentafluoride	0.1	0.7
Bromochloromethane	200	1,050
Butane	600	1,400
n-Butyl lactate	5	25
Cadmium, dust & salts (as Cd)	----	0.05
C Cadmium oxide fume (as Cd)	----	0.05
Calcium hydroxide	----	d
Calcium cyanamide	----	0.5
Calcium hydroxide	----	. 5
Caprolactam		
Dust	----	1
Vapor	5	20
Captafol		
(Difolatan) - Skin	----	0.1
Captan	----	5
Carbofuran (Furadan)	----	0.1
Carbon disulfide - Skin	20	60
Carbon tetrabromide	0.1	1.4
Carbon tetrachloride - Skin	10	65
Catechol (Pyrocatechol)	5	20
Cellulose (paper fiber)	----	d
Cesium hydroxide	----	2
Chlorodifluoromethane	1,000	3,500
Chlorpyrifos (Dursban) - Skin	----	0.2
o-Chlorostyrene	50	285
o-Chlorotoluene - Skin	50	250
2-Chloro-6-(trichloromethyl pyridine (N-Serve)	----	10
Chromates, certain insoluble forms	----	0.05a
Chromic acid and Chromates, (as Cr.)	----	0.05
Clopidol (Coyden)	----	10
Corundum ($Al_2 O_3$)	----	d
Crufomate	----	5
Cyanamide	----	2
Cyanogen	10	20
Cyclohexylamine - Skin	10	40
Diazinon - Skin	----	0.1
1, 2-Dibromoethane (Ethylene Dibromide) - Skin	20	145
Dibrom	----	3
2-N-Dibutylaminoethanol - Skin	2	14
Dibutyl phosphate	1	5
C Dichloracetylene	0.1	0.4
Dichlorobenizidine - Skin	----	c
Dicrotophos (Bidrin) - Skin	----	0.25
Dicyclopentadiene	5	30
Dicyclopentadienyl iron	----	10
Diethylene triamine - Skin	1	4
Diethyl ether, see Ethyl ether	400	1,200
Diethyl phthalate	----	5
3, 5-Dinitro-o-toluamide (Zoalene)	----	5
Dioxathion (Delnav)	----	0.2
Diphenylamine	----	10
Diquat	----	0.5
Disulfuram	----	2
Disyston - Skin	----	0.1
2, 6-Ditertbutyl-p-cresol	----	10
Diuron	----	10
Dyfonate	----	0.1
Emery	----	d
Endosulfan (Thiodan) - Skin	----	0.1
Ethane	F	----
Ethion (Nialate) - Skin	----	0.4
Ethylene	F	----
Ethylene glycol,		
Particulate	----	10
Vapor	100	260
C Ethylidene norbornene	5	25
Fensulfothion (Dasanit)	----	0.1
C Formaldehyde	2	3
Formamide	20	30
Gasoline	----	h
Germanium tetrahydride	0.2	0.6
Glass, fibrous or dust	----	d
C Glutaraldehyde, activated or unactivated	----	(0.25)
Glycerin mist	----	d
Graphite (Synthetic)	----	d
Gypsum	----	d
Helium	F	----
Hexachlorocyclopentadiene	0.01	0.11
Hexafluoroacetone	0.1	0.7
C Hexylene glycol	25	125
Hydrogen	F	----
Hydrogenated terphenyls	0.5	5
Hydrogen fluoride	3	2
Hydrogen sulfide	10	15
Indene	10	45
Indium & Compounds (as In)	----	0.1
Iodoform	0.2	3
Iron pentacarbonyl	0.01	0.08
Iron salts, soluble (as Fe)	----	1
Isophorone diisocyanate Skin	0.01	0.06
Kaolin	----	d
Lead, inorg., fumes & dusts (as Pb)	----	0.15
Lead Chromate (as Cr)	----	0.05, bc

TABLE 56. (continued)

Substance	ADOPTED VALUES TWA	
	ppm^a	mg/m$^{3\,b)}$
Limestone	----	d
Magnesite	----	d
Manganese cyclopentadienyl tricarbonyl (as Mn) - Skin	----	0.1
Marble	----	d
Mercury (Alkyl compounds) - Skin, as Hg	0.001	0.01
Mercury (All forms except alkyl) as Hg	----	0.05
Methane	F	----
Methomyl (Lannate) - Skin	----	2.5
Methyl acrylonitrile - Skin	1	3
Methyl chloride	100	210
Methyl 2-cyanoacrylate	2	8
Methyl isoamyl ketone	100	475
Methylcyclopentadienyl manganese tricarbonyl (as Mn) - Skin	0.1	0.2
Methyl demeton - Skin	----	0.5
C Methylene bisphenyl isocyanate (MDI)	0.02	0.2
Methylene chloride (dichloromethane)	200	720
4,4'-Methylene bis (2-chloraniline) - Skin	0.02, A2	----
C Methylene bis (4-cyclohexylisocyanate)	0.01	0.11
C Methyl ethyl ketone peroxide	0.2	1.5
Methyl parathion - Skin	----	0.2
C Metnyl silicate	5	30
Monocrotopnos (Azodrin*)	----	0.25
β-Naphthylamine	----	c
Neon	F	----
4-Nitrodiphenyl	----	d
N-Nitrosodimethylamine (dimethylnitrosoamine) - Skin	----	b
Nonane	200	1,050
Paraffin wax fume	----	2
Particulate polycyclic aromatic hydrocarbons (PPAH) as benzene solubles	----	0.2, a
Pentaerythritol	----	d
Perchloroethylene - Skin	100	670
Phenothiazine - Skin	----	5
C Phenylphosphine	0.05	0.25
Phorate (Thimet) - Skin	----	0.05
m-Phthalodinitrile	----	5
Picloram (Tordon)	----	10
Plaster of Paris	----	d
Polychlorobiphenyls, see Chlorodiphenyls	----	----
Polytetrafluoroethylene decomposition products	----	f
C Potassium hydroxide	----	2
Propane	F	----
β-Propiolactone	----	b
Propylene	F	----
Propylene glycol monomethyl ether	100	360
Resorcinol	10	45
Rosin core solder pyrolysis products (as formaldehyde)	----	0.1
Rouge	----	d
Rubber cement	400	1,600
Sevin (see Carbaryl)	----	5
Silane (see Silicon tetrahydride)	0.5	7
Silicon	----	E
Silicon carbide	----	E
Silicon tetrahydride (Silane)	0.5	0.7
C Sodium azide	0.1	0.3
Starch	----	d
Styrene, monomer (Phenylethylene)	100	420
Succinaldehyde (see Glutaradehyde)	----	(0.25)
C Subtilisins (Proteolytic enzymes as 100% pure crystalline enzyme)	----	0.00006o)
Sucrose	----	d
Sulfur tetrafluoride	0.1	0.4
Teflon decomposition products	----	f
Tellurium	----	0.1
Tellurium hexafluoride, as Te	0.02	0.2
TEPP - Skin	0.004	0.05
4,4'-Thiobis (6-tert. butyl-m-cresol)	----	10
Tin oxide	----	d
Titanium dioxide	----	d
Toluene (toluol) - Skin	100	375
Trichloroethylene	100	535
Tricyclohexyltin hydroxide (Plictran)	----	5
Trimethyl benzene	25	120
Tungsten & compounds, as W		
Soluble	----	1
Insoluble	----	5
Vinyl acetate	10	30
Vinyl bromide	(250)	(1,100)
Vinyl cyclohexene dioxide	10	60
Vinylidene chloride	10	40
Welding fumes (Total particulate)	----	e
Wood dust (nonallergenic)	----	5
C m-Xylene α, α'-diamine	----	0.1
Zinc chromate (as Cr)	----	0.05
Zinc stearate	----	d

[a]A1a. *Human Carcinogens.* Substances, or substances associated with industrial processes, recognized to have carcinogenic or cocarcinogenic potential, with an assigned TLV:

	TLV
Arsenic trioxide production	As_2O_3, 0.05 mg/m^3 as As SO_2, C 5.0 ppm Sb_2O_3, 0.5 mg/m^3 (as Sb)
Asbestos, all forms	5 fibers/cc, >5 μm in length
bis (chloromethyl) ether	0.001 ppm
Chromite ore processing (chromate)	0.05 mg/m^3 (as Cr)
Nickel sulfide roasting, fume and dust	1.0 mg/m^3 (as Ni)
Particulate Polycyclic Aromatic Hydrocarbons (PPAH)	0.2 mg/m^3, as benzene solubles

[b]1B. *Human Carcinogens.* Substances, or substances associated with industrial processes, recognized to have carcinogenic potential without an assigned TLV:

4-Aminodiphenyl 9p-Xenylamine)
Benzidine production
β-Naphthylamine
4-Nitrodiphenyl

[c]A2. *Industrial Substances Suspect of Carcinogenic Potential for Man.* Chemical substances or substances associated with industrial processes, which are suspect of inducing cancer, based on either (1) limited epidemiologic evidence, exclusive of clinical reports of single cases, or (2) demonstration of carcinogenesis in one or more animal species by appropriate methods.

Antimony trioxide production	0.05 mg/m^3
Benzene--skin	10 ppm
Benz(a)pyrene	--
Beryllium	2.0 μg/m^3
Cadmium oxide production	0.05 mg/m^3
Chloroform	10 ppm
Chromates of lead and zinc (as Cr)	0.05 mg/m^3
3,3'-Dichlorobenzidine	--
Dimethylcarbamyl chloride	--

[d]Some Nuisance Particles* --TLV, 30 mppcf or 10 mg/m^3

Alundum (Al_2O_3)
Calcium carbonate
Calcium silicate
Cellulose (paper fiber)
Portland cement
Corundum (Al_2O_3)
Emery
Glass, fibrous**or dust
Glycerin mist
Graphite (synthetic)
Gypsum
Vegetable oil mists (except castor, cashew nut, or similar irritant oils)
Zinc oxide dust
Kaolin
Limestone
Magnesite
Marble
Mineral wool fiber
Pentaerythritol
Plaster of Paris
Rouge
Silicon
Silicon carbide
Starch
Sucrose
Tin oxide
Titanium dioxide
Zinc stearate

*When toxic impurities are not present, e.g., quartz <1%.
** 7 μm in diameter.

[e] *Welding Fumes--Total Particulate.* (NOC)--TLV, 5 mg/m^3

Welding fumes cannot be classified simply. The composition and quantity of both are dependent on the alloy being welded and the process and electrodes used. Reliable analysis of fumes cannot be made without considering the nature of the welding process and system bein examined; reactive metals and alloys such as aluminum and titantium are arc-welded in a protective, inert atmosphere such as argon. These arcs create relatively little fume, but an intense radiation which can produce ozone. Similar processes are used to arc-weld steels, also creating a relatively low level of fumes. Ferrous alloys also are arc-welded in oxidizing environments which generate considerable fume, and can produce carbon monoxide instead of ozone. Such fumes generally are composed of discreet particles of amorphous slags containing iron, manganese, silicon and other metallic constituents depending on the alloy system involved. Chromium and nickel compounds are found in fumes when stainless steels are arc-welded. Some coated and flux-cored electrodes are formulated with fluorides and the fumes associated with them can contain significantly more fluorides than oxides. Because of the above factors, arc-welding fumes frequently must be tested for individual constitutents which are likely to be present to determine whether specific TLV's are exceeded. Conclusions based on total fume concentration are generally adequate if no toxic elements are present in welding rod, metal, or metal coating and conditions are not conducive to the formation of toxic gases.

Most welding, even with primitive ventilation, does not produce exposures inside the welding helmet above 5 mg/m3. That which does, should be controlled.

[f] B1. *Polytetrafluoroethylene Decomposition Products.* Thermal decomposition of the fluorocarbon chain in air leads to the formation of oxidized products containing carbon, fluorine and oxygen. Because these products decompose in part by hydrolysis in alkaline solution, they can be quantitatively determined in air as fluoride to provide an index of exposure. No TLV is recommended pending determination of the toxicity of the products, but air concentrations should be minimal.

[g] Simple asphixiant.

[h] B2. *Gasoline.* The composition of gasoline varies greatly and thus a single TLV for all types of these materiasl is no longer applicable. In general, the aromatic hydrocarbon content will determine what TLV applies. Consequently the content of benzene, other aromatics and additives should be determined to arrive at the appropriate TLV (Elkins, et al. A.I.H.A.J. 24:99, 1963): Runion, ibid. 36, 338, 1975).

TABLE 57. CHEMICALS WITH ANSI STANDARDS FOR ACCEPTABLE CONCENTRATIONS

Carbon monoxide
Hydrogen sulfide
Carbon disulfide
Benzene
Cadmium fume and cadmium dusts
Manganese
Chromic acid and chromates
Inorganic mercury and non-alkyl organo
Xylene
Lead and its inorganic compounds
Toluene
Nitrogen dioxide
Methanol
Styrene
Formaldehyde
Carbon tetrachloride
Methyl chloride
Trichloroethylene
Ethylene dichloride
Tetrachloroethylene
Methylene chloride (Dichloromethane)
Methyl bromide (Monobromomethane)
Chlorine
Methyl chloroform (1,1,1-Trichloroethane)
Paradichlorobenzene (1,4-Dichlorobenzene)
Hydrogen fluoride and inorganic fluoride dusts
Beryllium and beryllium compounds
Ethylene dibromide
Acetone
Trifluoroethane (Fluorocarbon 113)
Trichlorofluoromethane (Fluorocarbon 11)
Dichlorodifluoromethane (Fluorocarbon 12)
Acetic acid

7.0 RADIATION REGULATIONS

Since World War II, several agencies have been responsible for various aspects of the regulations, use, and effects of radioactivity. The list of agencies currently responsible includes the following:

- Environmental Protection Agency (EPA), successor to Federal Radiation Council (FRC).
- Nuclear Regulatory Commission (NRC), successor to Atomic Energy Commission (AEC).
- Department of Health, Education, and Welfare (HEW)--Bureau of Radiological Health (BRH).
- Interstate Commerce Commission (ICC).
- Department of Defense (DOD)--military application only.
- Occupational Safety and Health Administration.

Advisory agencies whose recommendations are recognized by the various regulatory agencies include the National Council on Radiation Protection and Measurements (NCRPM), the International Commission on Radiological Protection (ICRP), the Department of Energy (DOE), and the American National Standards Institution (ANSI).

The Atomic Energy Act of 1954 established the basis for the regulation of radiation. It created the Atomic Energy Commission, the Federal Radiation Council, and the Bureau of Radiological Health. With the creation of the Environmental Protection Agency, the FRC was dissolved, and its functions were assigned to the EPA. When the Atomic Energy Commission was dissolved in 1975, its regulatory functions were assigned to the new Nuclear Regulatory Commission.

Since the Atomic Energy Act was written, regulations and recommendations addressing radiation have proliferated to a confusing degree. In 1977, the Committee on Energy and the Environment of the National Academy of Sciences wrote that "...the regulations are unnecessarily fragmented because of overlaps among regulatory agencies. Some overlap of responsibility may be unavoidable, but regulations should still be better coordinated so as to be reasonably consistent and free of confusing duplications."

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There are three major sets of regulations dealing with radiation protection (10 CFR 20, Standards for Protection Against Radiation; 40 CFR 190, Environmental Radiation Protection Standards for Nuclear Power Operations; and 40 CFR 141, Interim Primary Drinking Water Regulations--Radionuclides) plus a number of recommendations by the NCRP and others. These regulations and recommendations are set forth in the documents listed in Table 58. Each of these documents deals with a set of issues related to protection from radiation exposure. Table 59 indicates the particular issues addressed in each document.

The Standards for Protection Against Radiation are discussed further in Section 7.1, and the EPA Standards for Nuclear Power Operations are presented in Section 7.2. The Interim Primary Drinking Water Regulations pertinent to radionuclides were presented earlier in Section 5.2.

7.1 STANDARDS FOR PROTECTION AGAINST RADIATION

The comprehensive standards for protection against radiation were adopted in 1960 at 10 CFR, Part 20, to control radiation exposure levels for a wide variety of operations. Since the act was set forth by the Atomic Energy Commission, now defunct, its provisions are governed by the Nuclear Regulatory Commission. The regulations address both restricted and nonrestricted areas and prescribe limiting dosages to individuals as well as concentrations allowable in air and water.

Restricted areas are defined as places with controlled access for protection of individuals from radiation. Dosage limits for persons in restricted areas prescribed in rems per calendar quarter are given below.

- Whole body, head and trunk; active blood-forming organs; lens of eyes; or gonads: 1 1/4 rems/calendar quarter.
- Hands and forearms; feet and ankles: 18 3/4 rems/calendar quarter.
- Skin of whole body: 7 1/2 rems/calendar quarter.

Exposure to minors (individuals under 18 years of age) in restricted areas is limited to 10 percent of the figures above. In addition, the dose to the whole body when added to the accumulated occupational dose to the whole body shall not exceed 5(N-18) rems when N = the individual's age in years at his last birthday. Methods for determining the accumulated dose are specified. Whole body dose limits to individuals in unrestricted areas are prescribed as well. These are 2 mrem per hour, 100 mrem per week (assuming continuous exposure) and a measured accumulated annual dose of 0.5 rem.

The regulations establish limiting levels of radioactivity in air and water for 90 radioisotopes. Concentrations in restricted and unrestricted areas are specified. Because these regulations are applicable to a very large number of special types of chemical contaminants, i.e., radioisotopes, the complete listing of the concentration values specified will not be included here. Concentration limits for selected isotopes of general interest are presented in Table 60. A complete listing of the isotopes that are affected by these regulations is given in Table 61. The ranges of concentration values specified for this entire list of compounds is as follows:

Restricted areas:

Air 6×10^{-3} to 1×10^{-12} $\mu C_i/ml$

Water 4×10^{-1} to 4×10^{-7} $\mu C_i/ml$

Nonrestricted Areas:

Air 1×10^{-4} to 5×10^{-14} $\mu C_i/ml$

Water 1×10^{-2} to 3×10^{-8} $\mu C_i/ml$

Releases into sanitary sewage systems and into water in restricted areas are also controlled and specifications are established for soil burial. The total activity for any burial location is limited as well. Table 62, taken from Appendix C of the regulations, lists the isotopes and corresponding levels in microcuries, which, when multiplied by 1000, are the limiting values for activity at any burial location. Further restrictions are that burial shall be at a minimum depth of four feet; successive burials must be at least six feet apart; and no more than 12 burials shall be made per year. Disposal by incineration is prohibited except by approval.

Other issues regulated by the Standards for Protection Against Radiation include the following: medical treatments (no limits are placed on exposures of patient for diagnosis or therapy); bioassay services; personnel monitoring; caution signs and labels for radioactive materials and radiation areas; instruction of personnel; recordskeeping and reports on personnel monitoring, loss or theft of material, incidents involving overexposure or property damage, and dosages received by present and former employees; applications for exemptions; and enforcement.

7.2 ENVIRONMENTAL RADIATION PROTECTION STANDARDS FOR NUCLEAR POWER OPERATIONS

These EPA standards set limits on radiation dosage to members of the public and on release of radioactive materials into the environment, resulting from nuclear power generation with light-water reactors. Provisions mainly involve the "uranium fuel cycle," which means the operations of milling of uranium ore, chemical conversion of uranium, isotopic enrichment of uranium, fabrication of uranium fuel, generation of electricity by a light-water-cooled nuclear power plant using uranium fuel. The regulations are applicable to these operations to the extent that they directly support the production of electrical power for public use utilizing nuclear energy. Excluded are mining operations, operations at waste disposal sites, transportation of any radioactive material in support of these operations, and the reuse of recovered nonuranium special nuclear and byproduct materials from the cycle.

Standards for normal operations are as follows.

> Effective December 1, 1979, the annual dose equivalent does not exceed 27 millirems to the whole body, 75 millirems to the thyroid, and 25 millirems to any other organ of any member of the public as the result of exposures to planned discharges of radioactive materials, radon, and its daughters accepted, to the general environment from uranium fuel cycle operations and to radiation from these operations. For uranium ore milling operations, the effective date shall be December 1, 1980.

- In addition, the total quantity of radioactive materials entering the general environment from the entire uranium fuel cycle, per gigawatt-year of electrical energy produced by the fuel cycle, contains, effective January 1, 1983, less than 50,000 curies of krypton-85, 5 millicuries of iodine-129, and effective December 1, 1979, 0.5 millicuries combined of plutonium-239 and other alpha-emitting transuranic radionuclides with half-lives greater than one year.

Conditions are specified under which variations, for unusual operations, may be permitted.

These regulations are set forth at 40 CFR, Part 190, and were adopted by EPA on December 28, 1976.

TABLE 58. OFFICIAL DOCUMENTS IN WHICH REGULATIONS AND RECOMMENDATIONS DEALING WITH RADIATION ARE SET FORTH*

Regulations

10 CFR 20, Standards for Protection Against Radiation
40 CFR 190, Environmental Radiation Protection Standards for Nuclear Power Operations
40 CFR 141, Interim Primary Drinking Water Regulations - Radionuclides

Recommendations

NCRP Report 39, Basic Radiation Protection Criteria
NCRP Report 42, Radiological Factors Affecting Decision-Making in a Nuclear Attack
NCRP Report 43, Review of the Current State of Radiation Protection Philosophy
NCRP Report 46, Alpha-Emitting Particles in Lungs
NCRP Report 48, Radiation Protection for Medical and Allied Health Personnel
NCRP Report 50, Environmental Radiation Measurements
NCRP Report 52, Cesium-137 from the Environment to Man: Metabolism and Dose
NCRP Report 53, Review of NCRP Radiation Dose Limit for Embryo and Fetus in Occupationally-Exposed Women
NCRP Report 54, Medical Radiation Exposure of Pregnant and Potentially Pregnant Women
NCRP Report 55, Protection of the Thyroid Gland in the Event of Releases of Radioiodine
NCRP Report 56, Radiation Exposure from Consumer Products and Miscellaneous Sources
HEW/BRH, Regulations, Standards, and Guides for Microwaves, Ultraviolet Radiation, and Radiation from Lasers and Television Receivers - An Annotated Bibliography
NBS Handbook 69, Maximum Permissible Body Burdens and Maximum Permissible Concentrations of Radionuclides in Air and in Water for Occupational Exposure
ICRP Publication 6, Recommendations of the International Commission on Radiological Protection
ICRP Publication 8, The Evaluation of Risks from Radiation
FRC Report 1, Background Material for the Development of Radiation Protection Standards
Federal Register 9/26/61, Federal Radiation Council: Radiation Protection Guidance for Federal Agencies
FRC REport 5, Background Material for the Development of Radiation Protection Standards (Iodine-131)
FRC Report 8, Guidance for the Control of Radiation Hazards in Uranium Mining
NAS Analytical Studies for US EPA, Vol. VI, Implications of Environmental Regulations for Energy Production and Consumption

*Specific issues addressed in each document are indicated in Table 59.

TABLE 59. OFFICIAL DOCUMENTS CONTAINING REGULATIONS AND RECOMMENDATIONS FOR RADIATION EXPOSURE

	10 CFR 20	40 CFR 190	40 CFR 141	NCRP Report 39	NCRP Report 42	NCRP Report 43	NCRP Report 46	NCRP Report 48	NCRP Report 50	NCRP Report 52	NCRP Report 53	NCRP Report 54	NCRP Report 55	NCRP Report 56	HEW/BRH	NBS Handbook 69	ICRP Publication 6	ICRP Publication 8	FRC Report 1	Federal Register 9/26/61	FCR Report 5	FCR Report 8	NAS Analytical Studies for US EPA
Personal dosage limits	X	X	X	X		X		X		X	X			X	X	X	X			X	X	X	X
Minors	X			X		X				X													
Pregnant women and fetuses				X		X				X	X	X							X				
Medical and dental exposure	X			X				X				X		X									
Drinking water contamination			X																				
Environmental effects - radioecology		X	X	X					X											X	X		X
Biological effects - somatic and genetic				X		X	X	X		X			X	X	X	X	X		X	X	X	X	X
Manmade sources - consumer products								X						X	X								
TV sets														X	X								
Lasers															X								
Radionuclides (general)	X													X		X	X			X			
Tritium			X																				
Iodine		X											X							X	X		
Cesium			X							X													
Radium			X																	X			
Radon and daughters		X																				X	
Uranium		X																				X	
Plutonium and transuranics		X																					
Alpha emitters		X	X				X																
Beta and photon emitters			X																				
Strontium			X																	X			
X-rays						X		X						X	X								
Microwaves														X	X								
Ultraviolet radiation														X	X								
Nuclear power		X																					X
Uranium fuel cycle		X																					X
Uranium mining																						X	X
Workroom standards	X	X																					
Occupational exposure	X	X		X		X		X			X					X			X			X	X
Waste disposal	X																						X
Caution sign	X																						
Records and reports	X							X															
Loss and theft of radioactive material	X																						
Risks of radiation																		X				X	X
Radiation protection criteria				X																X			
Radiation protection costs																						X	X
Radiation protection philosophy						X																	X
Accidents, terrorism, or nuclear attack	X			X	X								X										X

TABLE 60. LIMITING AIR AND WATER CONCENTRATIONS OF RADIOACTIVITY ABOVE NATURAL BACKGROUND FOR SELECTED RADIOISOTOPES IN RESTRICTED AND NON-RESTRICTED AREAS

	Limiting Concentration in μC_i/ml			
	Restricted area		Non-restricted area	
Isotope	Air	Water	Air	Water
Natural uranium				
Soluble	7×10^{-11}	5×10^{-4}	3×10^{-12}	2×10^{-5}
Insoluble	6×10^{-11}	5×10^{-4}	2×10^{-12}	2×10^{-5}
Natural thorium				
Soluble	3×10^{-11}	3×10^{-5}	10^{-12}	10^{-6}
Insoluble	3×10^{-11}	3×10^{-4}	10^{-12}	10^{-5}
Strontium 90				
Soluble	1×10^{-9}	1×10^{-5}	3×10^{-11}	3×10^{-7}
Insoluble	5×10^{-9}	1×10^{-3}	2×10^{-10}	4×10^{-5}

Table 61. ISOTOPES WITH RADIOACTIVITY LIMITATIONS FOR AIR AND WATER

Element (Atomic number)	Isotope
Actinium (89)	Ac 227
	Ac 228
Americium (95)	Am 241
	Am 242m
	Am 242
	Am 243
	Am 244
Antimony (51)	Sb 122
	Sb 124
	Sb 125
Argon (18)	A 37
	A 41
Arsenic (33)	As 73
	As 74
	As 76
	As 77
Astatine (85)	At 211
Barium (56)	Ba 131
	Ba 140
Berkelium (97)	Bk 249
	Bk 250
Beryllium (4)	Be 7
Bismuth (83)	Bi 206
	Bi 207
	Bi 210
	Bi 212
Bromine (35)	Br 82
Cadmium (48)	Cd 109
	Cd 115m
	Cd 115
Calcium (20)	Ca 45
	Ca 47
Californium (98)	Cf 249
	Cf 250
	Cf 251
	Cf 252
	Cf 253
	Cf 254
Carbon (6)	C 14 (CO_2)
Cerium (58)	Ce 141
	Ce 143
	Ce 144
Cesium (55)	Cs 131
	Cs 134m
	Cs 134
	Cs 135
	Cs 136
	Cs 137
Chlorine (17)	Cl 36
	Cl 38
Chromium (24)	Cr 51
Cobalt (27)	Co 57
	Co 58m
	Co 58
	Co 60
Copper (29)	Cu 64
Curium (96)	Cm 242
	Cm 243
	Cm 244a
	Cm 245
	Cm 246
	Cm 247
	Cm 248
	Cm 249
Dysprosium (66)	Dy 165
	Dy 166
Einsteinium (99)	Es 253
	Es 254m
	Es 254
	Es 255
Erbium (68)	Er 159
	Er 171
Europium (63)	Eu 152 (T/2=9.2 hrs)
	Eu 152 (T/2=13 yrs)
	Eu 154
Fermium (100)	Fm 254
	Fm 255
	Fm 256
Fluorine (9)	F 18
Gadolinium (64)	Gd 153
	Gd 159
Gallium (31)	Ga 72
Germanium (32)	Ge 71
Gold (79)	Au 196
	Au 198
	Au 199
Hafnium (72)	Hf 181
Holmium (67)	Ho 166
Hydrogen (1)	H3
Indium (49)	In 113m
	In 114m
	In 115m
	In 115
Iodine (53)	I 125
	I 126
	I 129
	I 131
	I 132
	I 133
	I 134
	I 135
Iridium (77)	Ir 190
	Ir 192
	Ir 194
Iron (26)	Fe 55
	Fe 59
Krypton (36)	Kr 85m
	Kr 85
	Kr 87
	Kr 88
Lanthanum (57)	La 140
Lead (82)	Pb 203
	Pb 210
	Pb 212
Lutetium (71)	Lu 177
Manganese (25)	Mn 52
	Mn 54
	Mn 56
Mercury (80)	Hg 197m
	Hg 197
	Hg 203
Molybdenum (42)	Mo 99
Neodymium (60)	Nd 144
	Nd 147
	Nd 149
Neptunium (93)	Np 237
	Np 239
Nickel (28)	Ni 59
	Ni 63
	Ni 65
Niobium (Columbium)(41)	Nb 93m
	Nb 95
	Nb 97
Osmium (76)	Os 185
	Os 191m
	Os 191
	Os 193
Palladium (46)	Pd 103
	Pd 109
Phosphorus (15)	P 32

TABLE 61. (continued)

Element (Atomic number)	Isotope
Platinum (78)	Pt 191 Pt 193 Pt 193m Pt 197m Pt 197
Plutonium (94)	Pu 238 Pu 239 Pu 240 Pu 241 Pu 242 Pu 243 Pu 244
Polonium (84)	Po 210
Potassium (19)	K 42
Praseodymium (59)	Pr 142 Pr 143
Promethium (61)	Pm 147 Pm 149
Protactinium (91)	Pa 230 Pa 231 Pa 233
Radium (88)	Ra 223 Ra 224 Ra 226 Ra 228
Radon (86)	Rn 220 Rn 222
Rhenium (75)	Re 183 Re 186 Re 187 Re 188
Rhodium (45)	Rh 103m Rh 105
Rubidium (37)	Rb 86 Rb 87
Ruthenium (44)	Ru 97 Ru 103 Ru 105 Ru 106
Samarium (62)	Sm 147 Sm 151 Sm 153
Scandium (21)	Sc 46 Sc 47 Sc 48
Selenium (34)	Se 75
Silicon (14)	Si 31
Silver (47)	Ag 105 Ag 110m Ag 111
Sodium (11)	Na 22 Na 24
Strontium (38)	Sr 85m Sr 85 Sr 89 Sr 90 Sr 91 Sr 92
Sulfur (16)	S 35
Tantalum (73)	Ta 182
Technetium (43)	Tc 96m Tc 96 Tc 97m Tc 97 Tc 99m Tc 99
Tellurium (52)	Te 125m Te 127m Te 127 Te 129m Te 129 Te 131m Te 132
Terbium (65)	Tb 160
Thallium (81)	Tl 200 Tl 201 Tl 202 Tl 204
Thorium (90)	Th 227 Th 228 Th 230 Th 231 Th 232 Th natural Th 234
Thulium (69)	Tm 170 Tm 171
Tin (50)	Sn 113 Sn 125
Tungsten (Wolfram) (74)	W 181 W 185 W 187
Uranium (92)	U 230 U 232 U 233 U 234 U 235 U 236 U 238 U 240 U natural
Vanadium (23)	V 48
Xenon (54)	Xe 131m Xe 133 Xe 133m Xe 135
Ytterbium (70)	Yb 175
Yttrium (39)	Y 90 Y 91m Y 91 Y 92 Y 93
Zinc (30)	Zn 65 Zn 69m Zn 69
Zirconium (40)	Zr 93 Zr 95 Zr 97

TABLE 62. ALLOWABLE MICROCURIES SPECIFIED FOR MATERIALS ADDRESSED BY STANDARDS FOR PROTECTION AGAINST RADIATION

Material	Microcuries	Material	Microcuries
Americium-241	.01	Nickel-63	10
Antimony-122	100	Nickel-65	100
Antimony-124	10	Niobium-93m	10
Antimony-125	10	Niobium-95	10
Arsenic-73	100	Niobium-97	10
Arsenic-74	10	Osmium-185	10
Arsenic-76	10	Osmium-191m	100
Arsenic-77	100	Osmium-191	100
Barium-131	10	Osmium-193	100
Barium-133	10	Palladium-103	100
Barium-140	10	Palladium-109	100
Bismuth-210	1	Phosphorus-32	10
Bromine-82	10	Platinum-191	100
Cadmium-109	10	Platinum-193m	100
Cadmium-115m	10	Platinum-193	100
Cadmium-115	100	Platinum-197m	100
Calcium-45	10	Platinum-197	100
Calcium-47	10	Plutonium-239	.01
Carbon-14	100	Polonium-210	0.1
Cerium-141	100	Potassium-42	10
Cerium-143	100	Praseodymium-142	100
Cerium-144	1	Praseodymium-143	100
Cesium-131	1,000	Promethium-147	10
Cesium-134m	100	Promethium-149	10
Cesium-134	1	Radium-226	.01
Cesium-135	10	Rhenium-186	100
Cesium-136	10	Rhenium-188	100
Cesium-137	10	Rhodium-103m	100
Chlorine-36	10	Rhodium-105	100
Chlorine-38	10	Rubidium-86	10
Chromium-51	1,000	Rubidium-87	10
Cobalt-58m	10	Ruthenium-97	100
Cobalt-58	10	Ruthenium-103	10
Cobalt-60	1	Ruthenium-105	10
Copper-64	100	Ruthenium-106	1
Dysprosium-165	10	Samarium-151	10
Dysprosium-166	100	Samarium-153	100
Erbium-169	100	Scandium-46	10
Erbium-171	100	Scandium-47	100
Europium-152 9.2h	100	Scandium-48	10
Europium-152 13 yr	1	Selenium-75	10
Europium-154	1	Silicon-31	100
Europium-155	10	Silver-105	10
Fluorine-18	1,000	Silver-110m	1
Gadolinium-153	10	Silver-111	100
Gadolinium-159	100	Sodium-24	10
Gallium-72	10	Strontium-85	10
Germanium-71	100	Strontium-89	1
Gold-198	100	Strontium-90	0.1
Gold-199	100	Strontium-91	10
Hafnium-181	10	Strontium-92	10
Holmium-166	100	Sulphur-35	100
Hydrogen-3	1,000	Tantalum-182	10
Indium-113m	100	Technetium-96	10
Indium-114m	10	Technetium-97m	100
Indium-115m	100	Technetium-97	100
Indium-115	10	Technetium-99m	100
Iodine-125	1	Technetium-99	10
Iodine-126	1	Tellurium-125m	10
Iodine-129	0.1	Tellurium-127m	10
Iodine-131	1	Tellurium-127	100
Iodine-132	10	Tellurium-129m	10
Iodine-133	1	Tellurium-129	100
Iodine-134	10	Tellurium-131m	10
Iodine-135	10	Tellurium-132	10
Iridium-192	10	Terbium-160	10
Iridium-194	100	Thallium-200	100
Iron-55	100	Thallium-201	100
Iron-59	10	Thallium-202	100
Krypton-85	100	Thallium-204	10
Krypton-87	10	Thorium (natural)	50
Lanthanum-140	10	Thullium-170	10
Lutetium-177	100	Thullium-171	10
Manganese-52	10	Tin-113	10
Manganese-54	10	Tin-125	10
Manganese-56	10	Tungsten-181	10
Mercury-197m	100	Tungsten-185	10
Mercury-197	100	Tungsten-187	100
Mercury-203	10	Uranium (natural)	50
Molydenum-99	100	Uranium-233	.01
Neodymium-147	100	Uranium-234--Uranium-235	.01
Neodymium-149	100	Vanadium-48	10
Nickel-59	100	Xenon-131m	1,000

TABLE 62. (continued)

Material	Microcuries	Material	Microcuries
Xenon-133	100	Any alpha emitting radionuclide not listed above or mixtures of alpha emitters of unknown composition	.01
Xenon-135	100		
Ytterbium-175	100		
Yttrium-90	10		
Yttrium-91	10	Any radionuclide other than alpha emitting radionuclides, not listed above or mixtures of beta emitters of unknown composition	.1
Yttrium-92	100		
Yttrium-93	100		
Zinc-65	10		
Zinc-69m	100		
Zinc-69	1,000		
Zirconium-93	10		
Zirconium-95	10		
Zirconium-97	10		

For purposes of §§ 20.203[a] and 20.304[b], where there is involved a combination of isotopes in known amounts the limit for the combination should be derived as follows: Determine, for each isotope in the combination, the ratio between the quantity present in the combination and the limit otherwise established for the specific isotope when not in combination. The sum of such ratios for all the isotopes in the combination may not exceed "1" (i.e., "unity"). Example: For purposes of § 20.304[b] if a particular batch contains 20,000 μc of Au^{198} and 50,000 μc of C^{14}, it may also include not more than 300 μc of I^{131}. This limit was determined as follows:

$$\frac{20{,}000\ \mu c\ Au^{198}}{100{,}000\ \mu c} + \frac{50{,}000\ \mu c\ C^{14}}{100{,}000\ \mu c} + \frac{300\ \mu c\ I^{131}}{1{,}000\ \mu c} = 1$$

The denominator in each of the above ratios was obtained by multiplying the figure in the table by 1,000 as provided in § 20.304.

[a] § 20.203 pertains to caution signs, labels, signals, and controls.

[b] § 20.304 pertains to disposal by burial in soil.

8.0 TOXIC SUBSTANCES CONTROL ACT

The Toxic Substances Control Act (TSCA) enacted on October 11, 1976 provides the authority for the Environmental Protection Agency to secure information on all new and existing chemical substances and to control any of these substances determined to cause unreasonable risk to the public health or environment. The hazards controlled under these regulations are those that are not controlled by other acts, i.e., CAA, FWPCA, FIFRA, SDWA. If it is determined that a substance can be controlled by the enforcement of an existing regulation, that method will be used in preference to new regulations under TSCA.

In order to carry out the mandate of the Toxic Substances Control Act, the Interagency Testing Committee was established. The agencies represented are Environmental Protection Agency, Occupational Safety and Health Administration, Council on Environmental Quality, National Institute of Environmental Health and Safety, National Cancer Institute, National Science Foundation, and Department of Commerce. It is the responsibility of this committee to make recommendations to EPA on substances for which further testing is needed. In order to make this determination more efficient, a priority system had to be established. First, a "Candidate List" of all existing chemicals was made. From this, all drugs, food additives, pesticides, and noncommercial chemicals were eliminated. This resulted in an "Initial List" of approximately 3,500 compounds. From this list, all chemicals already regulated, well characterized as hazardous, well characterized as inert, and natural products that would be difficult to test were eliminated, creating a "Master List" of 2,100 compounds. This list was prioritized according to human and environmental exposure levels, and 300 compounds were selected for the "Preliminary List." From this list, 100 of the compounds were selected on which to have detailed dossiers prepared. From these compounds, the Interagency Committee may select as many as 50 compounds or groups of compounds to be thoroughly tested in the 12 months following their selection. The compounds in Table 63 were selected in November 1977 with recommendations for testing.

On October 2, 1978, additional compounds were added to the priority testing list but no recommendations were made as to the tests to be conducted. The compounds added were chlorinated benzenes (tri-, tetra- and penta-), glycidol (and derivatives) and 1, 2-dichloropropane. The testing procedures was designed to yield the following information.

1. Physical and chemical properties of the chemical and its byproduct.
2. Health and ecological effects.
3. Environmental behavior and fate.
4. Likely sources of environmental discharges and exposed populations.
5. Technological and economic factors.
6. Industry's risk assessment.

At the completion of this premarket review by the Interagency Committee, one of the following actions may be taken.

1. No action. (Manufacture and marketing proceed without delay.)
2. No action but a notice in the Federal Register if further study is needed.
3. Delay in manufacture pending submission of more data.
4. Manufacture and marketing may proceed with regulation.
5. No action now but further evaluation to be required with regard to manufacture and distribution of the new substance after commercialization.

To date only two substances have been regulated under the Toxic Substances Control Act. They are polychlorinated biphenyls (PCBs) and fully halogenated chlorofluoroalkanes.

8.1 POLYCHLORINATED BIPHENYLS (40 CFR, Part 761)

Under TSCA, the EPA has issued a ban on the manufacture, processing and distribution of products containing PCBs. Exporting of PCB has also been banned. The use of PCBs to service transformers, use of railroad transformers, hydraulic die casting systems, and carbonless carbon paper has been extended five years. The processing and distribution of PCB fluids for transformer servicing and servicing of mining equipment is authorized until July 1, 1979. The use of PCB fluids in mining machinery is permitted until December 31, 1981. All other uses of PCB fluids or mixtures containing more than 50 ppm PCB is prohibited.

PCB mixtures must be disposed of in an acceptable incinerator or chemical waste landfill. All PCB containers or products containing PCBs should be clearly marked. Records should be maintained by the operator of each facility handling at least 45 kilograms of PCB. These records should include PCBs in use in transformers and capacitors, PCBs in transformers and capacitors removed from service, PCBs stored for disposal, and a report on the ultimate disposal of the PCBs. The report should include all transfers of the material from one site to another. At all times the PCB-containing vessels must be clearly marked.

8.2 FULLY HALOGENATED CHLOROFLUOROALKANES (40 CFR , Parts 712, 762)

In the second regulation, restrictions were placed on the use of fully halogenated chlorofluoroalkanes as an aerosol propellant. The compound cannot be manufactured for use as a propellant after October 15, 1978. The following uses are exempt from these restrictions.

1. Mercaptan stench warning devices.
2. Release agent for molds used in the production of plastic and elastomeric materials.
3. Flying insect pesticides for use in nonresidential food handling areas.
4. Diamond-grit spray.
5. Nonconsumer articles used as cleaner-solvent, lubricants, or coatings for electrical or electronic equipment.
6. Aircraft articles.
7. Defense articles.

TABLE 63. CHEMICALS UNDER CONSIDERATION FOR REGULATION UNDER TSCA

	Types of Testing Recommended					
Substance or Category	Carcinogenicity	Mutagenicity	Teratogenicity	Other Chronic Effects	Environmental Effects	Epidemiological Study
Alkyl Epoxides	X	X	X	X	X	X
Alkyl Phthalates					X	
Chlorinated Benzenes, (Mono- and Di-)	X	X	X	X	X	X
Chlorinated Paraffins	X	X	X	X	X	
Chloromethane	X	X	X	X		
Cresols	X	X	X	X	X	
Hexachloro-1,3-butadiene					X	
Nitrobenzene	X	X			X	
Toluene	X		X	X		X
Xylenes		X	X			X

9.0 FEDERAL INSECTICIDE, FUNGICIDE AND RODENTICIDE ACT

9.1 FEDERAL INSECTICIDE, FUNGICIDE, AND RODENTICIDE ACT (FIFRA)

According to this act, pesticides are any substance intended for preventing, destroying, repelling, or mitigating any pest. A pest is defined as any insect, rodent, nematode, fungus, weed, or any other form of terrestrial or aquatic plant or animal life or virus, bacterial organism, or other microorganism (except viruses, bacteria, or other microorganisms on or living in man or other living animals) which is declared by the EPA as being injurious to health and environment. All pesticides meeting this definition must be registered with EPA. Registration is for a limited period of five years. Registered pesticides are classified for either general or restricted use. Certain chemicals may be further restricted in that they must be applied either by or under the direct supervision of a certified applicator. All pesticides must be labeled clearly to specify ingredients, uses, warnings, registration number, and any use restrictions. There are also regulations specifying tolerance levels for certain pesticide chemicals in or on agricultural commodities. These regulations pertain to specific chemicals, and the permitted residues may vary from 0 to 100 ppm (calculated from the weight of the raw agricultural product) depending on the particular kind of crop involved.

The pesticide chemicals aldrin/dieldrin, DDT, DDD, DDE, endrin, and toxaphene are also regulated as toxic pollutants under Part 307a of the Federal Use Water Pollution Control Act. (See Section 4.5.) The pesticides, endrin, lindane, methoxy chlorophyll, toxaphene, 2, 4-D and 2,4, S-TP siluex are also regulated by Primary Drinking Water Standards (See Table 43, Section 5.1.)

9.2 CLASSIFICATION OF PESTICIDES

As stated in 40 CFR, Part 162, all pesticide chemicals must be registered before they may be distributed or sold. Any one who desires to sell or distribute any pesticide may apply for a registration for that pesticide. The burden of proof for the safety and efficacy of the pesticide rests upon the applicant. The applicant should also suggest a classification of either general use or restricted use for each proposed use of the chemical. The registration application should include complete proposed labeling, data supporting the safety and efficacy of the product and the complete formulation of the product. If the same product is to be sold under a different brand name, an amended or supplemental registration application should be submitted. If the label is to be changed and the product repackaged, an amended registration is required. If the product remains in an unbroken container and no significant changes appear in the labeling, a supplemental registration is required. After consideration of the application, the agency may classify the pesticide chemicals for either general or restricted use.

The EPA may place an additional restriction upon the use of certain pesticides and require that they be applied by only certified applicators. Applicators are certified by the various States under guidelines found in 40 CFR, Part 17. The applicator should demonstrate competency and understanding of the correct use and handling of pesticides by written examination administered by the State. The examination should include the following:

1. The understanding of labels.
2. Safety precautions necessary.
3. The potential risks to the environment.
4. The recognition of pests.
5. The selection of the appropriate pesticide.
6. Proper selection and use of pesticide application equipment.
7. Knowledge of applicable Federal and State laws and regulations affecting the use of pesticides.

Table 64 indicates those chemicals that have been classified for restricted use and are limited to use by or under the direct supervision of a certified applicator. The chemicals in Table 65 are currently under consideration for restricted classification.

9.3 PESTICIDE TOLERANCE LEVELS

Quantitative regulations specifying tolerances for certain pesticide chemicals in or on agricultural commodities have been established by EPA. These regulations are described in 40 CFR, Part 180, Subpart C. The regulations pertain to 310 specific compounds, and residue tolerance limits range from 0 to 100 ppm. Tolerances are expressed in terms of parts by weight of the pesticide chemical per 1 million parts by weight of the raw agricultural commodity.

Pesticide chemicals addressed by these regulations are listed in Table 66, in the order of presentation in the regulations. Due to the complexity of the regulations (i.e., different tolerances prescribed for various kinds of agricultural commodities--spinach, cucumbers, tomatoes, milk, etc.), no numerical specifications are included here. The reader is referred to the Part 180 (Subpart C) of CFR 40 for specific tolerance limits pertinent to a particular pesticide chemical included in the list.

TABLE 64. CLASSIFICATION OF THE USE OF PESTICIDE CHEMICALS

Active Ingredient	Formulation	Use Pattern	Classification
Acrolein	As sole active ingredient. No mixtures registered.	All uses	Restricted
Acrylonitrile	In combination with carbon tetrachloride. No registrations as the sole active ingredient.	All uses	Restricted
Aldicarb	As sole active ingredient.	Ornamental uses (indoor and outdoor)	Restricted
	No mixtures registered.	Agricultural crop uses.	Under further evaluation
Allyl alcohol	All formulations.	All uses	Restricted
Aluminum phosphide	As sole active ingredient. No mixtures registered.	All uses	Restricted
Azinphos methyl	All liquids with a concentration greater than 13.5 pct.	All uses	Restricted
	All other formulations.	All uses	Under further evaluation
Calcium cyanide	As sole active ingredient. No mixtures registered.	All uses	Restricted
Demeton	1 pct fertilizer formulation, 1.985 pct granular formulation.	All uses, including domestic uses.	Restricted
	All granular formulations, emulsifiable concentrates and concentrated solutions.	All uses	Restricted
Endrin	All emulsions, dusts, wettable powders, pastes, and granular formulations 2 pct and above.	All uses	Restricted
	All concentrations less than 2 pct.	All uses	Restricted
Ethyl parathion	All granular and dust formulations greater than 2 pct, fertilizer formulations, wettable powders, emulsifiable concentrates, concentrated suspensions, concentrated solutions.	All uses	Restricted
	Smoke fumigants.	All uses	Restricted
	Dust and granular formulations 2 pct and below.	All uses	Restricted
Fluoroacetamide/1081	As sole active ingredient in baits. No mixtures registered.	All uses	Restricted
Hydrocyanic acid	As sole active ingredient. No mixtures registered.	All uses	Restricted
Methomyl	As sole active ingredient in 1 pct to 2.5 baits (except 1 pct. fly bait).	Nondomestic outdoors-agricultural crops, ornamental and turf, all other registered uses.	Restricted
	All concentrated solution formulations.	Nondomestic outdoors-agricultural crops, ornamental and turf, all other registered uses.	Restricted
	90 pct wettable powder formulation (not in water soluble bags).	Nondomestic outdoors-agricultural crops, ornamental and turf, all other registered uses.	Restricted
	90 pct wettable powder formulation in water soluble bags.	Nondomestic outdoors-agricultural crops, ornamental and turf, all other registered uses.	Unclassified
	All granular formulations.	Nondomestic outdoors-agricultural crops, ornamental and turf, all other registered uses.	Unclassified

TABLE 64. (continued)

Active Ingredient	Formulation	Use Pattern	Classification
Methomyl (Continued)	All granular formulations.	Nondomestic outdoors-agricultural crops, ornamental and turf, all other registered uses.	Unclassified
	25 pct wettable powder formulations.	Nondomestic outdoors-agricultural crops, ornamental and turf, all other registered uses.	Unclassified
	In 1.24 pct to 2.5 pct dusts as sole active ingredient and in mixtures with fungicides and chlorinated hydrocarbon, inorganic phosphate and biological insecticides.	Nondomestic outdoors-agricultural crops, ornamental and turf, all other registered uses.	Unclassified
Metnyl bromide	All formulations in containers greater than 1.5 lb.	All uses	Restricted
	Containers with not more than 1.5 lb of methyl bromide with 0.25 pct to 2.0 pct chloropicrin as an indicator.	Single applications (nondomestic use) for soil treatment in closed systems.	Unclassified
	Container with not more, than 1.5 lb having no indicator.	All uses	Restricted
Methyl parathion	All dust and granular formulations less than 5 pct.	All uses	Restricted
	Microencapsulated	All uses	Restricted
	All dust and granular formulations 5 pct and greater and all wettable powders and liquids.	All uses	Restricted
Mevinphos	All emulsifiable concentrates and liquid concentrates.	All uses	Restricted
	Psycodid filter fly liquid formulations.	All uses	Restricted
	2 pct dusts	All uses	Restricted
Paraquat (dichloride) and paraquat bis (methyl sulfate).	All formulations and concentrations except those listed below.	All uses	Restricted
	Pressurized spray formulations containing 0.44 pct Paraquat bis(methyl sulfate) and 15 pct petroleum distillates as active ingredients.	Spot weed and grass control.	Unclassified
	Liquid fertilizers containing concentrations of 0.025 pct paraquat dichloride and 0.03 pct atrazine; 0.03 pct paraquat dichloride and 0.37 pct atrazine, 0.04 pct paraquat dichloride and 0.40 pct atrazine.	All uses	Unclassified
Picloram	All formulations and concentrations except tordon 101 R.	All uses	Restricted
	Tordon 101 R forestry herbicide containing 5.4 pct picloram and 20.9 pct 2.4-D.	Control of unwanted trees by cut surface treatment.	Unclassified
Sodium cyanide[1]	All capsules and ball formulations.	All uses	Restricted
Sodium fluoroacetato	All solutions and dry baits.	All uses	Restricted
Strychnine	All dry baits, pellets and powder formulations greater than 0.5 pct.	All uses	Restricted
	All dry baits, pellets and powder formulations.	All uses calling for burrow builders.	Restricted
	All dry baits, pellets and powder formulations 0.5 pct and below.	All uses except subsoil.	Restricted
	All dry baits, pellets and powder formulations 0.5 pct and below.	All subsoil uses.	Unclassified
Sulfotepp	Sprays and smoke generators.	All uses	Restricted
Tepp	Emulsifiable concentrate formulations.	All uses	Restricted

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[1] (Note-M-44 sodium cyanide capsules may only be used by certified applicators who have also taken the required.

TABLE 65. PESTICIDES TO BE CONSIDERED FOR RESTRICTED CLASSIFICATION

Carbofuran
Carbon disulfide
Chlorfenvinphos
Chloropicrin
Clonitralid
Cycloheximide
Dicrotophos
Dimethoate
Dioxathion
Diquat
Disulfoton
Endosulfan
Endothall
EPN
Ethoprop
Ethyl 3-methyl-4-(methylthio) phenyl (1-methylethyl) phosophoramidate
Ethylene dibromide
Ethylene dichloride
Fensulfothion
Fenthion
Fonofos
Formaldehyde
Hexachlorobenzene
Methamidophos
Methidathion
Monocrotophos
Nicotine (alkaloid)
O,O-bis (p-chlorophenyl) acetimidoylphosphoramidothioate
Oxamyl
Oxydemeton methyl
Phorate
Phosphamidon
Phosphorus
Temephos
Terbufos
Toxaphene
Xylene (aquatic uses)
Zinc phosphide

TABLE 66. PESTICIDES ADDRESSED BY TOLERANCE LEVEL LIMITATIONS FOR RAW AGRICULTURAL PRODUCTS

Acephate
Aldicarb
Aldrin
Allethrin
Aluminum phosphide
Ametryn
Amiben
4-Amino-6-(1)-dimethylethyl-3(methylthio)-1,2,4-triazin-5(4H)-one
4-Aminopyridine
Ammoniates of [ethylene bis-(dithiocarbamate)] zinc and ethylene bis(dithio carbamic acid bimolecular and trimolecular cyclic anhydrosulfides and disulfide
Ammonium sulfamate
Aramite
Atrazine
Barban
Benomyl
Bentazon
Benzadox
Bifenox
Biphenyl
1,1-Bis(p-chlorophenyl) (2,2,2-Trichloroethanol)
2,4-Bis(isopropylamino)6-methylthio-S-triazine
Boron
Bromacil
Bromides, inorganic
O-(4-bromo-2-chlorophenyl)-O-ethyl-S-propyl phosphorothioate
3-4-(Bromo-3-chlorophenyl)-1-methoxy-1-methyl urea
3-(p-Bromophenyl)-1-methoxy-1-methyl urea
Butralin
sec-Butylamine
2-(sec-Butylamino)-4-ethylamino-6-methoxy- -triazine
2-tert-Butylamino-4-ethylamino-6-methylthio- -triazine
N-Butyl-N-ethyl-α,α,α-trifluoro-2,6-dinitro-p-toluidine
Cacodylic acid
Calcium arsenate
Calcium cyanide
Calcium hypochlorite
Captan
Captafol
Carbaryl
Carbofaran
Carbophenothion
Carboxim
Chlordane
Chlordimeform
2-Chloroallyl diethyldithiocarbamate
Chlorobenside
2-Chloro-4,6-bis(isopropyl-amino)-S-triazine
Chlorobromuron
2-Chloro-N,N-diallylacetatemide
2-Chloro-1(2,4-dichlorophenyl)vinyl diethylphosphate
2-Chloro-2',6'-diethyl-N-(methoxy methyl)
2-Chloro-1-(3-ethoxy-4-nitrophenoxy)-4-trifluoromethyl benzene
2[4-Chloro-6-(ethylamino)-S-triazin-2-yl]amino-2-methyl-propionitrile
2-Chloro-N-(2-ethyl-6-methyl-phenyl)-N-(2-methoxy-1-methyl ethyl)acetamide
2-Chloro-N-isopropylacetamilide
Chloroneb
1-Chloro-2-Nitropropane
p-Chlorophenoxy acetic acid
2-(m-Chlorophenoxy)propionic acid
N(4-Chlorophenylamino)carbonal-2,6-difluorobexamide
p-Chlorophenyl-2,4,5-trichlorophenyl sulfide
6-Chloropicolinic acid
Chloropropylate
Chlorothalonil
2-Chloro-1-(2,4,5-trichlorophenyl)vinyl dimethyl phosphate
Chloroxuron
Chlorpyrifos
CIPC
Copper arsenate
Copper carbonate (basic)
Coumaphos
Cyano(3-phenoxyphenyl)methyl-4-chloro-alpha (1-methylethyl)benzene acetate)
Cyclic methylene dithioimido-carbonate
Cycloheximide
Cyprazine
2,4-D
Dalapon
Daminoxide
DDD
DDT
Demeton
Desmedipham
Dialifor
Dibromochloropropane
Dicamba
Dichlobenil
Dichlone
S-2,3-Dichloroallyl diisopropyl-thiocarbamate
1-Dichloro-2,2-bis (diethyl-phenyl)ethane
2,4-Dichloro-6-O-chloro anilino-S-triazine
3,5-Dichloro-N-(1,1-dimethyl-2-propynyl)benzamide
2,6-Dichloro-4'-nitroaniline
4-(2,4-Dichlorophenoxy)butyric acid
2,4-Dichlorophenyl-p-nitrophenyl ether
3',4'-Dichloropropionalide
Dieldrin
N^3,N^3-Diethyl-2,4-dinitro-6-(trifluoromethyl)-m-phenylene-diamine
O,O-Diethyl-S-[2-(ethylthio)ethyl]phosphorodithioate
O,O-Diethyl-O-2-isopropyl-4-methyl-6-pyrimidynyl phosphorothioate
Diethyl-O-(2-iso-propyl)-6-methyl (4-pyrimidinyl)phosphorothioate
Diethyl-O-[p-(methylsulfinyl)phenyl] phosphorothioate
N,N-Diethyl-2-(1-naphthalenyl oxy)-propionamide
O-O-Diethyl-O-2-pyrazinyl phosphorothioate
Difenzoquat
S-(O,O-Diisopropyl phosphorodithioate of N-(2-mercaptoethyl)benzene sulfoniamide
Dimethoate
2-(Dimethylamino)-5,6-dimethyl-4-pyramidinyl dimethylcarbamate
O,O-Dimethyl-O-p-(dimethyl sulfamayl)phenyl phosphorothioate
3,5-Dimethyl-4-methylthio phenyl methyl carbamate
C,O-Dimethyl-S-[4-oxo-1,2,3-benzotriazin-3(4H)-yl methyl]phosphorodithioate
Dimethyl phosphate of 3-Hydroxy-n-methyl-cis-crotonimide
Dimethyl phosphate of α-methylbenzyl-3-hydroxy-cis-crotonate
O,S-Dimethyl phosphoroamidothioate
N,N-Dimethylpiperidinum chloride
Dimethyltetrachlorotere phthalate
Dimethyl 2,2,2-trichloro-1-hydroxyethyl phosphonate
4,6-Dinitro-o-cresol
2,4-Dinitro-6-octyl phenyl crotonate and 2,6-dinitro-4-octylphenyl crotonate
Dinoseb
Dioxathion
Diphenamid
Diphenyl amine
Dipropyl isocinchomeronate
Diquat
Diuron
Dodecachloroactahydro-1,3,4-metheno-2H-cyclo buta[cd]pentalene
Dodine
Dypropetryn
Endosulfan
Endothall
Endrin
EPN
Erthroprop
Ethephon
Ethiolate
Ethion
2-Ethoxy-2,3-dihydro-3,3-dimethyl-5-benzofuranyl methanesulfonate
3-Ethoxy-3-trichloromethyl-1,2,4-thiadiazole
2-Ethyl amino-4-isopropyl amino-6-methylthio-S-triazine
S-Ethylcyclohexylethylthiocarbamate
Ethyl 4,4-dichlorobenzilate
S-Ethyl diisobutylthiocarbamate
S-Ethyl dipropylthiocarbamate

TABLE 66. (continued)

Ethylene oxide
S-Ethyl hexahydro-1H-azepine-1-carbothioate
Ethyl 3-methyl-4-(methylthio phenyl)(1-methylethyl)
  phosporamidate
O-Ethyl-O-[4(methylthio)phenyl]-S-propyl phosphorodithioate
O-Ethyl-S-phenyl ethyl phosphorodithioate
N-(1-Ethylpropyl)-3,4-dimethyl-2,6-dinitrobenzeamine
S-[2(Ethylsulfinyl)ethyl]O,O-dimethyl phosphorothioate
2-Ethylthio-4,6-bis(isopropyl amino)-S-triazine
Fenthion
Ferbam
Fluchloralin
Fluometuron
Fluorine compounds
Fluorodifen
Folpet
Formetanate hydrochloride
Gibberillic acid
Glyodin
Glyphosate
Glyphosine
Gossyplure
Heptachlor and heptachlor epoxide
Hexachlorophene
Hexakis
Hydrogen cyanide
Isopropalin
Isopropyl 4,4'-dichlorobenzilate
Lead arsenate
Lindane
Linuron
Magnesium arsenate
Malathion
Maleic hydrazide
Maneb
Manganous dimethyldithio carbamate
Mefluide
Mercaptobenzothiazole
N-(mercaptomethyl)phthalimide-S-(O,O-dimethyl)
  phosphorodithioate
Methane arsonic acid
Methazole
Methidathion
Methomyl
Methoprene
Methoxychlor
m-(1-Methylbutyl)phenyl methylcarbamate and
  m-(1-ethylpropyl)phenyl methyl carbamate
2-Methyl-4-chlorophenoxy-acetic acid
4-(2-Methyl-4-chlorophenoxy)butyric acid
Methyl-2-[4-2',4'-dichlorophenoxy)-phenoxyl]
  propanoate
Methyl 3-[dimethoxyphosphinyloxy]butenoate
  (alpha and beta isomers)
6-Methyl-1,3-dithiolo[4,5-6]quinoxalin-2-one
4-Methyl sulfonyl-2,6-dinitro-N,N-dipropyloniline
Metolachlor
Mineral oil
Naled
a-Naphthalene acetamide
α-Naphthalene acetic acid
β-Naphthoxy acetic acid
2-(α-Naphthoxy)-N,N-diethyl-propionimide
N-1-Naphthyl phthalamic acid
Neodecanoic acid
Nicotine-containing compounds
Norea
Norflurazon
n-Octyl bicycloheptenedicarboximide
2-n-Octyl-4-isothiazolin-3-one
Orthoarsenic acid
Oryzalin
Ovex
Oxadiazon
Oxamyl
Oxyfluorofen
Oxytetracycline hydrochloride
Ovex
Paraquat
Parathion
Pendimethalin
Pentachloronitrobenzene
Perfluidone
Phenmediphan
o-Phenyl phenol and its sodium salt
Phorate
Phosalone
Phosphamidon
Phosphorothiate (O,O-diethyl)
Picloram
Piperonyl butoxide
Potassium arsenate
Profluralin
Prometryn
Propargite
Propazine
S-Propyl butylethylthiocarbamate
S-Propyldipropylthiocarbamate
Pyrazon
Pyrethrins
Schradan
Secbumeton
Sesone
Silicone dioxide
Silvex
Simazine
Sodium arsenate
Sodium azide
Sodium dehydroacetate
Sodium dimethyldithiocarbamate
Sodium trichloroacetate
Streptomycin
Sulfphenone
Tartar emetic
TDE (DDD)
Terbacil
Terbufos
Terbutryn
Terbutyl azine
Terpene polychlorinates
1,2,4,5-Tetrachloro-3-nitrobenzene
Tetradifon
Tetraethyl pyrophosphate
Tetraiodoethylene
O,O,O',O'-Tetramethyl-O,O'-thiodi-p-phenylene
  phosphorothioate
Thiobandazole
Thiophante-methyl
2-(Thiocyanomethyl)thiobenzothiazole
Thiram
Toxaphene
Tributylphosphoro ithioite
S,S,S,-Tributyl phosphorotrithioite
S-2,3,3,-Trichloroallyl diisopropyl thio
  carbamate
Trichlorobenzyl chloride
Trichloropheny1 acetic acid
Tricyclohexyltin hydroxide
Trifluralin
Triiodobenzoic acid
3,4,5-Trimethyl phenylmethyl carbamate and
  2,3,5-trimethyl phenylmethyl carbamate
Triphenyltin hydroxide
Zinab
Zinc ion and maneb coordination products
Zinc phosphide
Zinc sulfate (basic)
Ziram

10.0 NOISE CONTROL ACT

It is under the Noise Control Act of 1972 that the regulations on noise are promulgated. It specifies that noise limitations should be set for major noise sources in the following categories:

1. Construction equipment.
2. Transportation equipment (airplanes, railroads, and trucks).
3. Any motor or engine.
4. Electrical or electronic equipment.

It provides for the proper labeling of the noise level produced by products capable of emitting noises that might adversely affect the public health or welfare. It also provides for correct labeling of the effectiveness of products sold for the purpose of reducing noise.

The act encourages the development of low-noise emission products by providing that they will have priority in government procurement policies provided their cost does not exceed 125 percent of the cost of the least expensive product for which they would substitute. Regulations limiting noise levels (in dBA) emitter from a variety of sources have been promulgated. These regulations are located in 40 CFR, Parts 203 and 204. The effective dates of the regulations vary. The promulgated and proposed regulations are found in Table 67.

Originally the problem of noise control was addressed by the Noise Pollution and Abatement Act of 1970. This act which was a section of the Clean Air Act directed the EPA to investigate and classify the major causes and sources of noise and to determine its effect on man and his environment. The Noise Control Act of 1972 was the result of this study.

The Noise Control Act of 1972 may be found in the Public Laws as P.L. 92-574, 86 Stat. 1234 as amended by P.L 94-301, 90 Stat. 590, May 31, 1976.

TABLE 67. NOISE REGULATIONS PROMULGATED OR PROPOSED

Noise Source	Noise Level in dBA	Date Effective
Locomotive--Stationary		
In gear	87	December 31, 1976
Idle	70	
Moving	90	
Railroad car--Under 72 km/hr	88	December 31, 1976
Over 72 km/hr	92	December 31, 1976
Motor carriers in interstate commerce--Under	86	October 15, 1975
--Over	90	
-- Full throttle stationary	88	
Medium and heavy trucks	83	January 1, 1978
	80	January 1, 1982
Exemptions for fire trucks and mobile homes		
Portable air compressors--<250 ft^3/min	76	January 1, 1978
-->250 ft^3/min	76	July 1, 1978
[a]Crawler tractors 20-199 HP	77	March 1, 1981
	74	1984
20-450 HP	83	1981
	80	1984
[a]Wheel loaders 20-249 HP	79	1981
	76	1984
250-500 HP	84	1981
	80	1984
[a]Wheel tractors 20+ HP	74	March 1, 1981
[a]New truck-mounted solid waste compactors	78	January 1, 1979
	75	1982
[a]Exterior bus noise	83	January 1, 1979
	80	1983
	77	1985
[a]Interior bus noise	86	1979
	83	1983
	80	1985
[a]Street motorcycles	83	January 1, 1980
	80	1982
	78	1985
[a]Moped-type	70	1980
Offroad below 170 cc	83	1980
	80	1982
	78	1985
[a]Offroad above 170 cc	86	1980
	82	1983

[a] Proposed

11.0 RESOURCE CONSERVATION AND RECOVERY ACT

The Resource Conservation and Recovery Act (RCRA) of 1976 is the legislation that is the basis for the regulations of solid waste. It provides for the protection of the public health and welfare by supplying guidelines to protect the quality of groundwater, surface water, and the ambient air from contamination by solid waste. The EPA has established that the problem of disposal of nonhazardous solid waste is primarily a State and local problem and has proposed criteria to assist the States in making regulations to assure the environmentally safe disposal of solid waste. The problem of hazardous wastes is viewed as a more severe problem and one that requires more stringent Federal regulations.

11.1 SOLID WASTE REGULATIONS

On February 6, 1978, the Office of Solid Waste proposed criteria (43FR7988) for the disposal of nonhazardous solid waste. The conditions enumerated in the proposal are designed to protect groundwater quality, surface water quality, environmentally sensitive areas, air quality, food chain crops, disease vectors, and safety. Final promulgation is scheduled for July 1979. According to the proposed regulations, the States will be required to survey and evaluate all existing disposal sites within one year of final promulgation. It is estimated that several hundred thousand such sites will need to be evaluated. Draft guidelines for the design and operation of landfills were issued August 1978. These contained recommendations for leachate control, gas migration control, and groundwater monitoring. A formally proposed regulation is scheduled for March 1979, and final promulgation for January 1980. The guidelines for landspreading of solid wastes may also be proposed in 1979. Guidelines for the surface impoundment of solid waste are planned for 1980. The States will be required to develop solid waste plans to implement the Federal criteria. According to the proposed guidelines, the States' plans should be developed within 18 months of the promulgation of the Federal criteria. The plans should cover a minimum time of five years. The States will be required to review the plan on a regular basis every three years.

11.2 PROPOSED HAZARDOUS WASTE REGULATIONS

The Office of Solid Waste proposed new hazardous waste regulations on December 18, 1978 (43FR58996). These regulations will control hazardous waste from the point of generation through transportation, storage, and ultimate disposal of the substance determined to be hazardous. The proposed regulations are waste specific rather than industry specific. Wastes that are ignitable, corrosive, reactive, or toxic are to be considered hazardous. EPA proposes to add radioactivity, infectiousness, phytotoxicity, teratogenicity, and mutagenicity to the list of characteristics to be considered in determining hazardous wastes. When the proper test protocols are available, a list of substances that may be considered hazardous are found in Tables 68-74. Table 75 contains a concentration of various pollutants that may be used to determine if a waste is toxic. A specified extraction procedure is to be formed on the solid waste and if the values in Table 75 are exceeded the waste is considered hazardous. These values are ten times the the National Interim Drinking Water Standards and will change as the National Interim Drinking Water Standards are revised. Processes generating potentially hazardous wastes are listed in Table 76.

Under the proposed guidelines it is the responsibility of the waste generator to determine if the waste is hazardous. If a generator produces less than 100 kg of hazardous waste, he is not subject to regulations under the current proposal. If it is determined that a generator produces hazardous wastes in sufficient quantities, he is responsible for the proper disposal. He must obtain a permit to manage the waste onsite or to transport it to another facility for proper disposal. The proposed regulations contain strict requirements for the siting and operation of hazardous waste facilities. Extensive long-term monitoring of such facilities will be required to assure that surface and groundwater are not contaminated. It has been suggested that permit requirements for hazardous waste disposal be integrated with the NPDES permit under the Clean Water Act and the underground injection plan permits issued under the Safe Drinking Water Act. These permit programs are operated by the various States. The States would be required to promulgate regulations to implement the Federal guidelines for hazardous wastes. These regulations must then be approved by EPA. If however a State fails to make or enforce its own acceptable regulations, the responsibility for the control of hazardous waste will revert to EPA.

11.3 RESOURCE CONSERVATION AND RECOVERY

RCRA also provides for the encouragement of conservation by the recycling of many resources by municipalities and commercial establishments. The specific resources identified as suitable for recycling are paper, beverage containers, corrugated boxes, tires, and energy from solid waste. EPA has conducted seminars for local officials to help them in establishing recycling programs for these resources. Federal procurement policy gives preference to products making the greatest use of recycled materials provided the cost is not significantly higher than the product for which it is to be substituted.

TABLE 68. CONTROLLED SUBSTANCE LIST[a]

Aloperidin
Amantadine
4-Aminoantipyrin acetamide
Aminopterin
3-Amino-1,2,4-triazole
6-Azauridine
Azo dyes
Benzene
Bisulfan
Carbon tetrachloride
Chloroquine
Chloroambucil
Cobalt salts
Colchicine
Coumarin derivatives
Cycasin
Cyclophosphamide
Dextroamphetamine sulfate
Diazepam (Valium)
Diethylstilbesterol
Dimethylaminoazobenzene
Dimethylnitrosamine
Diphenylhydantoin
Ethionine
Grisefulvin
1-Hydroxysafrole
Maleic hydrazide
Methotrexate
Methylthiouracil
Mytomycin-C
d-Pencillamine
Phenylalanine
Phorbol esters
Quinine
Reserpine
p-Rosanlin
Safrole
Serotonin
Streptomycin
Testosterone
Thioacetamide thiourea
Trimethadione
d-Tubocurarine

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[a] Substances considered carcinogenic, mutagenic or teratogenic.

TABLE 69. HAZARDOUS PESTICIDES NOT LISTED ELSEWHERE

Aramite
BAAM
Benomyl
Benzac
Chloranil
Chlorobenzilate
DBCP
Diallate
Dimethoate
EBDC
Kepone
Maleic Hydrazide
Mirex
Monuron
OMPA
PCNB
Phenarzine Chloride
Polychlorinated Terphenyls
Pronamide
Strobane
2,4,5-T
1080/1081
Thiophonate Methyl
Trysben

TABLE 70. SUBSTANCES CONSIDERED HAZARDOUS BY THE DEPARTMENT OF TRANSPORTATION

Acetaldehyde ammonia
Acetone cyanohydrin
Acetylene tetrabromide
Allethrin
Ammonium hydrosulfide solution
Ammonium polysulfide solution
Aniline oil drum
Aniline oil, liquid
Antimony lactate, solid
Antimony potassium tartrate, solid
Antimony sulfide, solid
Barium cyanide, solid
*Beryllium compound, n.o.s.
Bone oil
Bromoacetone
Brucine, solid (dimethoxy strychnine)
Calcium cyanide, solid, or
Calcium cyanide mixture, solid
Camphene
Carbaryl
Carbolic acid, liquid or phenol, liquid (liquid tar acid containing over 50% benzophenol)
Carbolic acid, or phenol
Carbon tetrachloride
Chemical ammunition, nonexplosive (containing a Poison B material)
Chemical ammunition, nonexplosive (containing a Poison A material)
Chloroform
4-chloro-o-toluidine hydrochloride
Chloropicrin, absorbed
Chloropicrin and methyl chloride mixture
Chloropicrin, liquid
Chloropicrin mixture (containing no compressed gas or Poison A liquid)
Cocculus, solid (fishberry)
*Compound, tree or weed killing, liquid
Copper cyanide
*Cyanide or cyanide mixture, dry
Cyanogen bromide
Cyanogen chloride (containing less than 0.9% water)
DDT
Diazinon
Dibromodifluoromethane
Dichlorobenzene, ortho, liquid
Dichlorobenzene, para, solid
Dichlorodifluorolthylene
Dichloromethane or methylene chloride
2,4 dichlorophenoxyacetic acid
Dieldrin
Dinitrobenzene, solid or dinitrobenzol, solid
*Dinitrobenzene solution
Dinitrochlorobenzol, solid or dinitrochlorobenzene
Dinitrocyclohexylphenol
*Dinitrophenol solution
*Disinfectant, liquid
*Disinfectant, solid
*Drugs, n.o.s., liquid
*Drugs, n.o.s., solid
Ethylene chlorohydrin
Ethylene dibromide (1,2-dibromomethane)
Ferrophosphorus
Flue dust, poisonous
Formaldehyde, or formalin solution (in containers of 110 gallons or less)
Germane
Grenade without bursting charge: with Poison A gas charge
Grenade without bursting charge: with Poison B charge
Hexachloroethane
Hexaethyl tetraphosphate and compressed gas mixture
Hexaethyl tetraphosphate, liquid
Hexaethyl tetraphosphate mixture, dry (containing more than 2% hexaethyl tetraphosphate)
*Hexaethyl tetraphosphate mixture, dry (containing not more than 2% hexaethyl tetraphosphate)
Hexaethyl tetraphosphate mixture, liquid (containing more than 25% hexaethyl tetraphosphate)
*Hexaethyl tetraphosphate mixture, liquid (containing not more than 25% hexaethyl tetraphosphate)
Hydrocyanic acid, liquified
Hydrocyanic acid (prussic), solution (5% or more hydrocyanic acid)
Hydrocyanic acid solution, less than 5% hydrocyanic acid
*Insecticide, dry, n.o.s.
Insecticide, liquified gas, containing Poison A material or Poison B material
*Insecticide, liquid, n.o.s.
London purple, solid
Malathion
*Medicines, n.o.s., liquid
*Medicines, n.o.s., solid
*Mercaptan mixture, aliphatic (in containers of 110 gallons or less)
Methyl bromide and ethylene dibromide mixture, liquid
Methyl bromide and more than 2% chloropicrin mixture, liquid
Methyl bromide and nonflammable, nonliquified compressed gas mixture, liquid (including up to 2% chloroprin)
Methyl bromide, liquid (bromoethane) including up to 2% chloropicrin
Methyl chloroform
Methyl parathion, liquid
*Methyl parathion mixture, dry
*Methyl parathion mixture, liquid (containing 25% or less methyl parathion
Methyl parathion mixture, liquid (containing over 25% methyl parathion)
Mipafox
Motor fuel antiknock compound, or antiknock compound
Napthalene or napthalin
Nickel cyanide, solid
Nicotine hydrochloride
Nicotine, liquid
Nicotine, salicylate
*Nicotine sulfate, liquid
Nicotine sulfate, solid
Nicotine tartrate
Nitric oxide
Nitroaniline
Nitrobenzol, liquid (oil or mirbane, nitrobenzene
Nitrochlorobenzene, ortho, liquid
Nitrochlorobenzene, meta or para, solid
Nitrogen dioxide, liquid
Nitrogen peroxide, liquid
Nitrogen tetraoxide, liquid
Nitroxylol
*Organic phosphate, organic phosphate compound, or organic phosphorus compound; mixed with compressed gas
*Organic phosphate, organic phosphate compound, or organic phosphorus compound; liquid
*Organic phosphate, organic phosphate compound, or organic phosphorus compound; solid or dry
*Organic phosphate mixture, organic phosphate compound mixture, or organic phosphorus compound mixture, liquid
*Organic phosphate mixture, organic phosphate compound mixture, or organic phosphorus compound mixture, liquid
*Organic phosphate mixture, organic phosphate compound mixture, or organic phosphorus compound mixture, solid or dry
Parathion and compressed gas mixture
Parathion, liquid
*Parathion mixture, dry
Parathion mixture, liquid
Perchloro-methyl-mercaptan
Perfluoro-2-butene
Phencaptan
Phenyl dichloro arsine
Phenylenediamine, meta or para, solid
Phosgene (diphosgene)
Phosphine
Poisonous liquid, n.o.s. or poison B, liquid, n.o.s.
Poisonous liquid or gas, n.o.s.
Poisonous solid, n.o.s., or poison B, solid, n.o.s.
Potassium cyanide, solid
*Potassium cyanide solution
Silver cyanide
Sodium azide
Sodium cyanide, solid
*Sodium cyanide, solution
Sodium dichromate
Sodium pentachlorophenate
Strontium arsenite, solid
*Strychnine salt, solid
Strychnine, solid
Tetrachloroethane
Tetrachloroethylene or perchloroethylene
Tetraethyl dithio pyrophosphate and compressed gas mixture
Tetraethyl dithio pyrophosphate, liquid
Tetraethyl dithio pyrophosphate, mixture, dry
Tetraethyl dithio pyrophosphate, mixture, liquid
Tetraethyl lead, liquid (including flash point for export shipment by water)
Tetraethyl pyrophosphate and compressed gas mixture
Tetraethyl pyrophosphate, liquid
Tetraethyl pyrophosphate, mixture, dry
Tetraethyl pyrophosphate, mixture, liquid
Tetramethyl methylene diamine
*Thallium salt, solid n.o.s.
Thallium sulfate, solid
Thiophosgene
Thiram
Toluenediamine
Trichloroethylene
Zinc cyanide

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*Not regulated unless the commodity meets the DOT definition of hazard.

n.o.s. = not otherwise specified.

TABLE 71. SELECTED PRIORITY POLLUTANTS PROPOSED TO MAKE SOLID WASTE HAZARDOUS

Acenaphthene
Acrolein
Acrylonitrile
Benzene
Benzidine
Chlorobenzene
1,2,4-Trichlorobenzene
Hexachlorobenzene
1,2-Dichloroethane
1,1,1-Trichloroethane
1,1-Dichloroethane
1,1,2-Trichloroethane
Chloroethane
Bis(chloromethyl) ether
Bis(2-chloroethyl) ether
2-Chloroethyl vinyl ether (mixed)
2-Chloronaphthalene
2,4,6-Trichlorophenol
Parachloro-m-cresol
2-Chlorophenol
1,3-Dichlorobenzene
3,3-Dichlorobenzidine
1,1-Dichloroethylene
1,2-trans-Dichloroethylene
2,4-Dichlorophenol
1,2-Dichloropropane
1,2-Dichloropropylene (1,3-dichloropropene)
2,4-Dimethylphenol
2,4-Dinitrotoluene
2,6-Dinitrotoluene
1,2-Diphenylhydrazine
Ethylbenzene
Fluoranthene
4-Chlorophenyl phenyl ether
4-Bromophenyl phenyl ether
Bis(2-chloroisopropyl) ether
Bis(2-chloroethoxy) methane
Methyl chloride (chloromethane)
Bromoform (tribromomethane)
Dichlorobromomethane
Trichlorofluoromethane
Dichlorofluoromethane
Dichlorodifluoromethane
Chlorodibromomethane
Hexachlorobutadiene
Hexachlorocyclopentadiene
Isophorone
2-Nitrophenol
4-Nitrophenol
4,6-dinitro-o-cresol
N-nitrosodimethylamine
N-nitrosodiphenylamine
N-nitrosodi-n-propylamine
Pentachlorophenol
Bis(2-ethylhexyl)phthalate
Butyl benzyl phthalate
Di-n-butyl phthalate
Di-n-octyl phthalate
Diethyl phthalate
Dimethyl phthalate
Benzo(a)anthracene (1,2-benzanthracene)
Benzo(a)pyrene (3,4-benzopyrene)
3,4-Benzofluoranthene
Benzo(k)fluoranthane (11,12-benzofluoranthene)
Chrysene
Acenaphthylene
Anthracene
Benzo(g,h,i)perylene (1,12-benzoperylene)
Fluorene
Phenanthrene
Dibenzo(a,h)anthracene (1,2,5,6-dibenzanthracene)
Indeno(1,2,3-c,d)pyrene (2,3-o-phenylenepyrene)
Pyrene
Toluene
Vinyl chloride (chloroethylene)
Aldrin
Chlordane (technical mixture & metabolites)
A-endosulfan-Alpha
B-endosulfan-Beta
Endosulfan sulfate
Endrin aldehyde
Heptachlor
Heptachlor epoxide
a-BHC-Alpha
b-BHC-Beta
g-BHC-Delta
PCB-1242 (Arochlor 1242)
PCB-1254 (Arochlor 1254)
PCB-1221 (Arochlor 1221)
PCB-1232 (Arochlor 1232)
PCB-1248 (Arochlor 1248)
PCB-1260 (Arochlor 1260)
PCB-1016 (Arochlor 1016)
2,3,7,8-Tetrachlorodibenzo-p-dioxin (TCDD)

*These substances are not covered by general characteristics or listed in any other specific list.

TABLE 72. INCOMPATIBLE HAZARDOUS WASTE

The mixing of a Group A waste with a Group B waste may have the potential consequence as noted.

Group 1-A	Group 1-B
Acetylene sludge	Acid sludge
Alkaline caustic liquids	Acid and water
Alkaline cleaner	Battery acid
Alkaline corrosive liquids	Chemical cleaners
Alkaline corrosive battery fluid	Electrolyte acid
Caustic wastewater	Etching acid liquid or solvent
Lime sludge and other corrosive alkalies	Liquid cleaning compounds
Lime wastewater	Pickling liquor and other corrosive acids
Lime and water	Spend acid
Spent caustic	Spent mixed acid
	Spent sulfuric acid

Potential consequences: Heat generation, violent reaction.

Group 2-A	Group 2-B
Asbestos waste, and other toxic wastes	Cleaning solvents
Beryllium wastes	Data processing liquid
Unrinsed pesticide containers	Obsolete explosives
Waste pesticides	Petroleum waste
	Refinery waste
	Retrograde explosives
	Solvents
	Waste oil and other flammable and explosive wastes

Potential consequences: Release of toxic substances in case of fire or explosion.

Group 3-A	Group 3-B
Aluminum	Any waste in Group 1-A or 1-B
Beryllium	
Calcium	
Lithium	
Magnesium	
Potassium	
Sodium	
Zinc powder and other reactive metals and metal hydrides	

Potential consequences: Fire or explosion; generation of flammable hydrogen gas.

Group 4-A	Group 4-B
Alcohols	Any concentrated waste in Groups 1-A or 1-B
Water	Calcium
	Lithium
	Metal hydrides
	Potassium
	Sodium
	SO_2Cl_3, $SOCl_2$, PCl_3, CH_3SiCl_2, and other water-reactive system

Potential consequences: Fire, explosion, or heat generation; generation of flammable or toxic gases.

Group 5-A	Group 5-B
Alcohols	Concentrated Group 1-A or 1-B wastes
Aldehydes	Group 3-A wastes
Halogenated hydrocarbons	
Nitrated hydrocarbons and other reactive organic compounds and solvents	
Unsaturated hydrocarbons	

Potential consequences: Fire, explosion, or violent reaction.

Group 6-A	Group 6-B
Spent cyanide and sulfide solutions	Group 1-B wastes

Potential consequences: Generation of toxic hydrogen cyanide or hydrogen sulfide gas.

(continued)

TABLE 72. (continued)

Group 7-A	Group 7-B
Chlorates and other strong oxidizers	Acetic acid and other organic acids
Chlorine	Concentrated mineral acids
Chlorites	Group 2-B wastes
Chromic acid	Group 3-A wastes
Hypochlorites	Group 5-A wastes and other flammable and combustible wastes
Nitrates	
Nitric acid, fuming	
Perchlorates	
Permanganates	
Peroxides	

Potential consequences: Fire, explosion, or violet reaction.

Source: "Law, Regulations and Guidelines for Handling of Hazardous Waste." California Department of Health, February 1975.

TABLE 73. INFECTIOUS AGENTS PROPOSED TO MAKE SOLID WASTE HAZARDOUS

BACTERIAL AGENTS
Actinobacillus
Arizona hinshawii--all serotypes
Bacillus anthracis
Bordetilla--all species
Borrelia recurrentis, B. vincenti
Clostridium botulinum, Cl. chauvoei, Cl. haemolyticum, Cl. histolyticum, Cl. novyi, Cl. septicum, Cl. tetani
Corynebacterium diptheriae, C. equi, C. renale
Diplococcus (streptococcus) pheumoniae
Erysipelothrix insidiosa
Escherichia coli--all enteropathogenic serotypes
Haemophilus ducreyi, H. influenzae
Herellea vaginicola
Klebsiella--all species and all serotypes
Listeria--all species
Mima polymorpha
Moraxella--all species
Mycobacteria
Mycoplasma--all species except Mycoplasma mycoides and Mycoplasma agalactiae
Neisseria gonorrhoeae N. meningitidis
Pasteurella
Salmonella--all species and all serotypes
Shigella--all species and all serotypes
Sphacrophorus necrophorus
Staphylococcus aureus
Streptobacillus moniliformis
Streptococcus pyogenes
Treponema carateum, T. pallidum and T. pertenue
Vibro fetus, V. comma, including biotype El Tor, and V. parahemolyticus
Actinobacillus mallei
Bartonella--all species
Brucella--all species
Francisella tularensis
Mycobacterium avium, M. bovis, M. tubercolosis
Pasteurella multocida type B ("buffalo" and other foreign virulent strains)
Pseudomonas pseudomallei
Yersenia pestis

FUNGAL AGENTS
Actinomycetes (including Nocardia species and Actinomyces species and Arachnia propionica)
Blastomyces dermatitidis
Cryptococcus neoformans
Paracoccidioides brasilienis
Coccidioides immitis
Histoplasma capsulatum
Histoplasma capsulatum var. duboisii

PARASITIAGENTS
Endamoeba histolytica
Leishmania sp.
Naegleria gruberi
Toxoplasma gondii
Toxocara canis
Trichinella spiralis
Trypanosoma cruzi
Schistosoma mansoni

VIRAL, RICKETSIAL AND CHLAMYDIAL AGENTS
Adenoviruses--human--all types
Cache Valley virus
Coxsackie A and B viruses
Cytomegaloviruses
Encephalomyocarditis virus (EMC)
Flanders virus
Hart Park virus
Hepatitis-associated antigen material
Herpes viruses--except Herpesvirus simiae (Monkey B virus)
Corona viruses
Influenza viruses--all types except A/PR8/34
Langat virus
Lymphogranuloma venereum agent
Measles virus
Mumps virus
Parainfluenza viruses--all types except Parainfluenza virus 3, SF4 strain
Polio viruses--all types, wild and attenuated
Pox viruses--all types except Alastrium, smallpox, monkey pox, and whitepox
Rabies virus--all strains except Rabies street virus
Reoviruses--all types
Respiratory syncytial virus
Rhinoviruses--all types
Rubella virus
Simiae viruses--all types except Herpesvirus simiae (Monkey B virus) and Marburg virus
Sindbis virus
Tensaw virus

PROPOSED RULES
Turlock virus
Vaccinia virus
Varicella virus
Vole rickettsia
Yellow fever virus, 17D vaccine strain
Alastrium, smallpox, monkey pox, and whitepox, when used in vitro
Arboviruses--West Nile and Semiliki Forest viruses are classified depending on the conditions or use and geographical location of the laboratory
Dengue virus, when used for transmission or animal inoculation experiments
Lymphocytic chorimeningitis virus (LCM)
Psittacosis-Ornithosis-Trachoma group of agents
Rabies street virus, when used in inoculations of carnivores
Rickettsia--all species except Vole rickettsia when used for transmission or animal inoculation experiments
Vesicular stomatitis virus
Yellow fever virus--wild, when used in vitro
Alastrun, Smallpox, Monkey pox and Whitepox, when used for transmission or animal inoculation experiments
Hemorrhagic fever agents, including Crimean hemorrhagic fever (Congo), Junin, and Machupo viruses, and others as yet undefined
Herpesvirus simiae (Monkey B virus)
Lassa virus
Marburg virus
Tick-borne encephalitis virus complex, including Russian spring-summer encephalitis, Kyasanur forest disease, Omsk hemorrhagic fever, and Central European encephalitis viruses
Venzuelan equine encephalitis virus, epidemic strains, when used for transmission or animal inoculation experiments
Yellow fever virus--wild, when used for transmission or animal inoculation experiments

A. Animal agents excluded from the United States by law.
Virus of foot and mouth disease
B. Animal agents excluded by USDA administrative policy
African horse sickness virus
African swine fever virus
Besnoitia besnoiti

(continued)

TABLE 73. (continued)

Borna disease virus
Bovine infectious petechial fever
Camel pox virus
Ephemeral fever virus
Fowl plague virus
Goat pox virus
Hog cholera virus
Louping ill virus
Lumpy skin disease virus
Nairobi sheep disease virus
Newcastle disease virus (Asiatic strains)
Mycloplasma mycoides (contagious bovine pleuro-pneumonia)
Mycoplasma agalactiae (contagious agalactia of sheep)
Rickettsia ruminatium (heart water)
Rift valley fever virus
Sheep pox virus
Swine vesicular disease virus
Teschen disease virus
Trypanosoma vivax (Nagana)
Theileria parva (East Coast fever)
Theileria annulata
Theileria lawrencei
Theileria bovis
Theileria hirci
Vesicular exanthema virus
Wesselsbron disease virus
Zyonema farciminosum (pseudofarcy)

TABLE 74. EXTRACT CONCENTRATION LEVELS DETERMINING HAZARDOUSNESS OF SOLID WASTE

Contaminant	Extract level, milligrams per liter
Arsenic	0.50
Barium	10.00
Cadmium	0.10
Chromium	0.50
Lead	0.50
Mercury	0.02
Selenium	0.10
Silver	0.50
Endrin (1,2,3,4,10,10-hexachloro-6, 7-epoxy-1,4,4a,5,6,7, 8,8a-octahydro-1, 4-endo, endo-5, 8-di methano naphthalene)	0.002
Lindane (1,2,3,4,5,6-hexachlorocyclohexane gamma isomer)	0.040
Methoxychlor (1,1,1-Trichloroethane) 2,2-bis (p-methoxyphenyl)	1.0
Toxaphene ($C_{10}H_{10}Cl_8$-technical chlorinated camphene, 67-69 percent chlorine)	0.050
2,4-D. (2,4-Dichlorophenoxyacetic acid)	1.0
2,4,5-TP Silvex (2,4,5-Trichlorophenoxypropionic acid)	0.10

TABLE 75. PROCESSES GENERATING HAZARDOUS WASTE

Waste rock and overburden from uranium mining (A)
Chlorinator residues and clarifier sludge from zirconium extraction (A)
Overburden and slimes from phosphate surface mining (A)
Waste gypsum from phosphoric acid production (A)
Slag and fluid bed prills from elemental phosphorus production (A)
Wool fabric dyeing and finishing wastewater treatment sludges (T, O)
Woven fabric dyeing and finishing wastewater treatment sludges (Y, O)
Knit fabric dyeing and finishing wastewater treatment sludges (O, T)
Yarn and stock dyeing and finishing wastewater treatment sludges (O, T)
Carpet dyeing and finishing wastewater treatment sludges (O, T)
Wool scouring wastewater treatment sludges (T)
Mercury bearing sludges from brine treatment from mercury cell process in chlorine production (T)
Sodium calcium sludge from production of chlorine by Down Cell process (R)
Mercury bearing brine purification muds from mercury cell process in chlorine production (T)
Wastewater treatment sludge from diaphragm cell process in production of chlorine (T)
Chlorinated hydrocarbon bearing wastes from diaphragm cell process in chlorine production (O, M)
Chromium bearing wastewater treatment sludge from production of chrome green pigment (T)
Chromium bearing wastewater treatment sludge and other chromium bearing wastes from production of chrome oxide green pigment (anhydrous & hydrated)
Ferric ferrocyanide bearing wastewater treatment sludges from the production of iron blue pigments (T)
Mercury bearing wastewater treatment sludges from the production of mercuric sulfide pigment (T)
Chromium bearing wastewater treatment sludges from the production of TiO_2 pigment by the chloride process (T)
Chromium bearing wastewater treatment sludges from the production of TiO_2 pigment by the sulfate process (T)
Arsenic bearing sludges from purification process in the production of antimony oxide (T)
Antimony bearing wastewater treatment sludge from production of antimony oxide (T)
Chromium or lead bearing wastewater treatment sludge from production of chrome yellows and oranges (lead chromate) (T)
Chromium or lead bearing wastewater treatment sludge from production of molybdate orange (lead molydate lead chromate) (T)
Zinc and chromium bearing wastewater treatment sludge from production of zinc yellow pigment (hydrated zinc potassium chromate) (T)
Ash from incinerated still bottoms (paint and pigment production) (T)
Arsenic bearing wastewater treatment sludges from production of boric acid (T)
Arsenic or organo-arsenic containing wastewater treatment sludges from production or veterinary pharmaceuticals (T.M.O.)
Wastewater treatment sludges from paint production (C,T)
Air pollution control sludges from paint production (T)
Vacuum still bottoms from the production of maleic anhydride (O)
Still bottoms from distillation of benzyl chloride (O)
Distillation residues from fractionating tower for recovery of benzene and chlorobenzenes (O, B)
Vacuum distillation residues from purification of 1-chloro-4-nitrobenzene (O, M)
Still bottoms or heavy ends from methanol recovery in methyl methacrylate production (O)
Heavy ends (still bottoms) from fractionator in production of epichlorohydrin (M, O)
Heavy ends from fractionation in ethyl chloride production (M, O)
Column bottoms or heavy ends from production of trichloroethylene (O, B)
Residues from the production of hexachlorophenol, trichlorophenol, and 2, 4, 5-T (O)
Heavy ends from distillation of vinyl chloride in production of vinyl chloride from ethylene dichloride (O)
Heavy ends from distillation of ethylene dichloride in vinyl chloride production (O)
Heavy ends or distillation residues from carbon tetrachloride fractionation tower (B, O)
Heavy ends from distillation of ethylene dichloride in ethylene dichloride production (O)
Purification column wastes from production of nitrobenzene (O)
Still bottoms from production of furfural (O)
Spent catalyst from fluorocarbon production (T, O)
Centrifuge residue from toluene diisocyanate production (O)
Lead slag from lead alkyl production (T)
Stripping still tails from production of methyl ethyl pyridines (I, O)
Still bottoms from aniline production (O)
Aqueous effluent from scrubbing of spent acid in nitrobenzene production (O)
Bottom stream from quench column in acrylonitrile production (O)
Bottom stream from wastewater stripper in production of acrylonitrile (O)
Still bottoms from final purification of acrylonitrile (O, M)
Solid waste discharge from ion exchange column in production of acrylonitrile (O, M)
Waste stream from purification of HCN in production of acrylonitrile (O, M)
Waste stream (column bottoms) from acetonitrile purification in production of acrylonitrile (O)
Sludges, wastes from tub washer (Ink Formulation) (T, C, O)

(continued)

TABLE 75. (continued)

Wastewater treatment, sludges from the production of dieldrin, chlordane, toxaphene, disulfoton, malathion, phorate, carbaryl, pentadiene, trifluralin, alachlor, methyl parathion, vernolcate, methomyl, carbofuran, captan, creosote, dithacarbamates, pentachlorophenol, bromacil, diuron, p-chlorobenzene and cloroxuron (O, M, B)
Wastewater from oxidation of aldrin solution in production of dieldrin (O, M, B)
Wastewater from extraction of dieldrin solution in production of dieldrin (O, M, B)
Wastewater and scrub water from chlorination of cyclopentadiene in production of chlordane (O, M, B)
Filter solids from filtration of hexachlorocyclopentadiene in production of chlordane (O, M, B)
Filter cake from filtration of toxaphene solution in production of toxaphene (O, M, B)
Unrecovered trieser from production of disulfoton (O, M)
Still bottoms from toluene reclamation distillation in production of disulfoton (O, M)
Filter cakes from filtration of dimethylphosphorothion and DMTA in production of malathion (O, M)
Liquid wastes from washing and stripping in production of malathion (O, M)
Liquid and solid wastes from the washing, stripping, and filtering of phorate in phorate production (O, M)
Filter cake from the filtration of diethylphosphorodithoric acid in the production of phorate (O, M)
Heavy ends and distillation residues from production of carbaryl (O, M)
2, 6-D waste byproduct from production of 2,4-D (O, M, B)
Heavy ends or distillation residues from distillation of tetrachlorobenzene in production of 2, 4, 5-T (O, M, B)
Scrubber and filter wastes from production of atrazine (O, M)
Filter cake from production of pyrethrins (O)
Filter cake from production of diazinon (O, M)
Byproduct salts in production of MSMA (O)
Byproduct salts in production of cacodylic acid (T)
Tars from manufacture of bicycloheptadiene and cyclopentadiene (O, M, B)
Wastewater treatment sludges from explosives, propellants, and initiating compounds manufacture (C, T, R, I)
Wastes recovered from acid vapor scrubber stream in the production of RDX/HMX (O, R, I)
Catch basin materials in RDX/HMX production (C)
Spent carbon columns used in treatment of wastewater-LAP operations (R)
Wastewater treatment sludges from production of initiating compounds (T)
Red water and pink water from TNT production (O)
Petroleum refining, high octane production neutralization HF alkylation sludge (T, O, M)
Petroleum refining DAF sludge (T, I, O)
Petroleum refining kerosene filter cakes (T, O, M)
Petroleum refining lube oil filtration clays (T, O, M)
Petroleum refining--slop oil emulsion solids (T, I, O)
Petroleum refining exchange bundle cleaning solvent (T, O)
API separator sludge (T, O)
Leather tanning and finishing: wastewater treatment sludge from chrome tannery, beamhouse/tanhouse (T)
Leather tanning and finishing: wastewater treatment screenings from sheepskin tannery, split tannery, and retan/finishers (T)
Trimmings and shavings from leather tanning and finishing chrome, split, beam/tanhouse and retan/finishers (T)
Wastewater treatment sludge from dehairing (R, T)
Coking: Decanter tank tar (T, O)
    : Decanter tank pitch sludge (T, O)
    : Oleum wash waste (C)
    : Caustic neutralization waste (C)
    : Ammonia still lime sludge (T)
Iron making: Ferromanganese blast furnace dust (T, R)
    : Ferromanganese blast furnace sludge (T)
    : Electric furnace dust and sludge (T)
Steel finishing: Alkaline cleaning waste (C)
    : Waste pickle liquor (C)
    : Cyanide-bearing wastes from electrolytic coating (T)
    : Chromate and dichromate wastes from chemical treatment (T)
    : Descaling acid (T, C)
Primary copper smelting and refining electric furnace slag, converter dust, acid plant sludge, and reverberatory dust (T)
Primary lead blast furnace dust (T)
Primary lead lagoon dredging from smelter (T)
Zinc acid plant blowdown lime treatment: gypsum cake (acid cooling tower and neutral cooling tower) (T)
Zinc production: oxide furnace residue and acid plant sludge (T)
Zinc anode sludge (T)
Primary antimony--electrolytic sludge (T)
Primary tungsten--digestion residues (T)

(continued)

TABLE 75. (continued)

Primary lead sinter dust scrubbing sludge (T)
Ferromanganese emissions control: baghouse dusts and scrubwater solids (T)
Ferrochrome silicon furnace emission control dust or sludge (T)
Ferrochrome emissions control: furnace baghouse dust, and ESP dust (T)
Primary antimony--pyrometallurgical blast furnace slag (T)
Secondary lead--scrubber sludge from SO_2 emission control, soft lead production (T)
Secondary lead--white metal production furnace dust (T)
Secondary copper--pyrometallurgical, blast furnace slag (T)
Secondary copper--electrolytic refining wastewater treatment sludge (T)
Secondary aluminum dross smelting--high salt slag plant residue (T)
Zinc--cadmium metal reclamation, cadmium plant residue (T)
Lead acid storage battery production wastewater treatment sludges (T)
Lead acid storage battery production clean-up wastes from cathode and anode paste production (T)
Nickel cadmium battery production wastewater treatment sludges (T)
Cadmium silver oxide battery production wastewater treatment sludge (T)
Mercury cadmium battery production wastewater treatment sludges (T)
Magnesium carbon battery production chromic acid wastewater treatment sludges (T)

12.0 MARINE PROTECTION, RESEARCH, AND SANCTUARIES ACT

The Marine Protection, Research, and Sanctuaries Act of 1972 protects the ocean waters from unregulated dumping operations. To accomplish this, the act provides for an Environmental Protection Agency program for all ocean dumping activities in territorial marine waters. The act also mandates a comprehensive and continuing research program into the effects of pollution, overfishing, and other man-induced ecological effects on the marine environment.

12.1 DESIGNATION OF MARINE SANCTUARIES

The Marine Protection, Research, and Sanctuaries Act of 1972 is enacted under Public Laws as indicated below:

> Public Law 92-532, 86 Stat. 1052, October 23, 1972, as amended by P.L. 93-254, by P.L. 93-472, 88 Stat. 1430, October 26, 1974; by P.L. 94-62, 89 Stat. 303, July 25, 1975; by P.L. 94-326, 90 Stat. 725, June 30, 1976 and by P.L. 95-153, 91 Stat. 1255, November 4, 1977.

Under the act, the Secretary of Commerce is given the authority to designate areas of the ocean as marine sanctuaries. These areas may include waters as far seaward as the outer edge of the Continental Shelf. Once an area has been designated as a marine sanctuary the activities in that area are regulated by the Secretary of Commerce in order to preserve and restore its conservation, recreational, ecological, and aesthetic values. Any activity that does not promote these goals will not be permitted.

12.2 CRITERIA FOR THE EVALUATION OF PERMIT APPLICATIONS FOR OCEAN DUMPING OF MATERIALS

Title II of the Marine Protection, Research, and Sanctuary Act pertains to ocean dumping. Under Section 102 of the act, criteria have been established by EPA to govern the application for and the issuance and denial of permits for the transportation and dumping of materials into

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ocean waters. These criteria set forth at 40 CFR, Part 227 are established to protect the waters of the territorial sea, the contiguous zone and the ocean.

Criteria for the evaluation of ocean dumping permit applications are prescribed for the four classifications of materials listed below:

1. Prohibited materials.
2. Constituents prohibited as other than trace contaminants.
3. Materials permitted for dumping subject to limitations.
4. Waste which may generally be approved for dumping.

The dumping of materials classified as prohibited will not be approved by EPA under any circumstances. Prohibited materials are (1) high level radioactive waste, (2) materials produced or used for biological, chemical, or radiological warfare, and (3) persistent inert synthetic or natural materials which may float or remain in suspension so as to interfere with legitimate uses of the ocean.

Constituents prohibited other than trace contaminants include organohalogen compounds, mercury and mercury compounds, cadmium and cadmium compounds, oil of any kind or in any form, and known or suspected carcinogens, mutagens, or teratogens. These constitutents will be considered to be present as trace contaminants only when they are present in materials otherwise acceptable for ocean dumping in such form and amounts that the dumping of the materials will not cause significant undesirable effects. Undesirable effects include the possibility of danger associated with high accumulation in marine organisms. Interim criteria are established to describe concentrations to be permitted for substances in this classification. These criteria are presented in Table 76. These criteria will be effective until acceptable bioassay procedures have been approved by EPA to determine the potential for significant undesirable effects due to the presence of these constituents.

Several types of materials are permitted for ocean dumping subject to limitations. Materials in this classification and the corresponding limiting conditions to be met are presented in Table 77.

Wastes which may be generally approved for dumping include the following:

1. Solid wastes consisting of inert natural minerals or material compatible with the ocean environment provided they are insoluble above the applicable trace or limiting permissible concentrations and are rapidly and completely settleable, or they are of particle size and density deposited or rapidly dispersed without damage to benthic, demersal, or pelagic biota.
2. Persistent inert synthetic or natural materials which have been processed in such a fashion that they will sink to the bottom and remain in place.
3. Dredged material determined to be environmentally acceptable for sumping.

TABLE 76. INTERIM CRITERIA FOR EVALUATING PERMIT APPLICATIONS FOR OCEAN DUMPING OF CONSTITUENTS PROHIBITED IN OTHER THAN TRACE QUANTITIES

Material	Criterion
Mercury and its compounds	Solid phase: <0.75 mg/kg Liquid phase: May not exceed average normal ambient concentration by more than 50 percent.
Cadmium and its compounds	Solid phase: <0.6 mg/kg Liquid phase: Not to exceed applicable marine water quality criteria after allowance for initial mixing.
Organohalogens	Waste as transported for dumping; < a concentration known to be toxic to marine organisms.
Oil and greases	Will not produce a visible sheen on water in a 1/100 dilution.

TABLE 77. MATERIALS PERMITTED FOR OCEAN DUMPING, SUBJECT TO LIMITATIONS

Material	Limitations
Liquid waste constituents immiscible with or slightly soluble in seawater (such as benzene, xylene, carbon disulfide, and toluene).	May be present in wastes only in concentrations below their solubility limits in seawater.
Radioactive materials other than those considered to be high-level radioactive wastes.	Must be appropriately containerized according to the properties of the material to be disposed.
Wastes containing living organisms.	May be dumped only if the material presents no danger to human health or the health of domestic animals, fish, shellfish, and wildlife.
Highly acidic or alkaline wastes.	Consideration to be given to effects on acidity or alkalinity at the disposal site and to the potential for the formation of toxic compounds.
Wastes containing biodegradable constituents or constituents which consume oxygen in any fashion.	Dissolved oxygen after allowance for initial mixing will not be depressed by more than 25% below normal ambient levels.

13.0 NATIONAL ENVIRONMENTAL POLICY ACT

The National Environmental Policy Act of 1969 (NEPA) provides for the consideration of environmental consequences of Federal actions. Under this act, Congress and all Federal agencies must submit an Environmental Impact Statement (EIS) for any project that directly or indirectly affects the human environment and uses Federal funding, Federal land leasing, or requires Federal permits for operation. Research projects that may have widespread application at a future date should also submit periodic evaluation of projected environmental impacts. These requirements apply to Federal projects both inside and outside the United States.

NEPA also created a Council on Environmental Quality. It is the duty of the council to review all environmental impact statements and make recommendations on the environmental merits of Federal actions. The council also develops and recommends policies to enhance the environmental quality of the United States.

13.1 GUIDELINES FOR PREPARATION OF ENVIRONMENTAL IMPACT STATEMENTS

Federal agencies begin to assess the environmental impact of a project when they begin the technical and economic feasibility studies. If this initial assessment indicates a significant environmental effect, the agency prepares a draft (EIS) to be circulated with the project proposal. The draft EIS should contain a discussion of the following topics:

1. A complete description of the proposed project.
2. A discussion of both the positive and negative effects on the environment.
3. A discussion of the relationship of the proposed action to land use plans and policies.
4. An evaluation of primary, secondary, direct and indirect environmental impact.
5. A thorough dicussion of alternatives to be proposed action including environmental consequences.

6. Any unavoidable negative environmental effect such as air or water pollution.
7. The relationship between the short- and long-term effects of the project.
8. Other interests and considerations that might offset the negative environmental aspects of the proposed action.

In a revision of these guidelines issued May 31, 1973, it was proposed that the EIS should be combined with any statements required by the Fish and Wildlife Coordination Act, the National Historic Preservation Act of 1966, the Endangered Species Act of 1972, and/or any other environmental review legislation. It was also proposed that the statement be limited in length to a maximum of 300 pages.

13.2 REVIEW OF THE DRAFT ENVIRONMENTAL IMPACT STATEMENT

The draft environmental impact statement must first receive an internal review by the initiating agency. Next it is sent for review to other Federal agencies having jurisdiction or special expertise in fields affected by the project. (A list of the various agencies and their areas of involvement may be found in Table 78.) The Environmental Protection Agency must also review each draft EIS prepared. The State and local governmental bodies in the area of the proposed project are also sent copies of the draft EIS by the Office of Management and Budget. The draft should also be made available to interested private citizens and groups of citizens. Each of the above groups may submit written comments and recommendations for improvement to or alternatives for the project under consideration. If a significant number of comments are received, a public hearing will be held on the EIS draft.

At the conclusion of the review process, a final draft Environmental Impact Statement should be prepared. It should include references to responsible opposing points of view raised in the review period. A copy or summary of all the comments received during the review period should be attached to the final draft. A copy of the final draft EIS should be sent to each reviewer and to EPA. Ten copies of the EIS and five copies of the comments should be sent to the Council for Environmental Quality (CEQ). A period of 90 days is then allowed for further comments before the CEQ makes a final recommendation on the proposal.

TABLE 78. AREAS OF ENVIRONMENTAL IMPACT AND FEDERAL AGENCIES AND FEDERAL STATE AGENCIES WITH JURISDICTION BY LAW OR SPECIAL EXPERTISE TO COMMENT THEREON

APPENDIX II—AREAS OF ENVIRONMENTAL IMPACT AND FEDERAL AGENCIES AND FEDERAL STATE AGENCIES[1] WITH JURISDICTION BY LAW OR SPECIAL EXPERTISE TO COMMENT THEREON[2]

AIR

Air Quality

- Department of Agriculture—
  - Forest Service (effects on vegetation)
- Atomic Energy Commission (radioactive substances)
- Department of Health, Education, and Welfare
- Environmental Protection Agency
- Department of the Interior—
  - Bureau of Mines (fossil and gaseous fuel combustion)
  - Bureau of Sport Fisheries and Wildlife (effect on wildlife)
  - Bureau of Outdoor Recreation (effects on recreation)
  - Bureau of Land Management (public lands)
  - Bureau of Indian Affairs (Indian lands)
- National Aeronautics and Space Administration (remote sensing, aircraft emissions)
- Department of Transportation—
  - Assistant Secretary for Systems Development and Technology (auto emissions)
  - Coast Guard (vessel emissions)
  - Federal Aviation Administration (aircraft emissions)

Weather Modification

- Department of Agriculture—
  - Forest Service
- Department of Commerce—
  - National Oceanic and Atmospheric Administration
- Department of Defense—
  - Department of the Air Force
- Department of the Interior
  - Bureau of Reclamation

WATER RESOURCES COUNCIL

WATER

Water Quality

- Department of Agriculture—
  - Soil Conservation Service
  - Forest Service
- Atomic Energy Commission (radioactive substances)
- Department of the Interior—
  - Bureau of Reclamation
  - Bureau of Land Management (public lands)
  - Bureau of Indian Affairs (Indian lands)
  - Bureau of Sports Fisheries and Wildlife
  - Bureau of Outdoor Recreation
  - Geological Survey
  - Office of Saline Water
- Environmental Protection Agency
- Department of Health, Education, and Welfare
- Department of Defense—
  - Army Corps of Engineers
  - Department of the Navy (ship pollution control)
- National Aeronautics and Space Administration (remote sensing)
- Department of Transportation—
  - Coast Guard (oil spills, ship sanitation)
- Department of Commerce—
  - National Oceanic and Atmospheric Administration
- Water Resources Council
- River Basin Commissions (as geographically appropriate)

Marine Pollution, Commercial Fishery Conservation, and Shellfish Sanitation

- Department of Commerce—
  - National Oceanic and Atmospheric Administration
- Department of Defense—
  - Army Corps of Engineers
  - Office of the Oceanographer of the Navy
- Department of Health, Education, and Welfare
- Department of the Interior—
  - Bureau of Sport Fisheries and Wildlife
  - Bureau of Outdoor Recreation
  - Bureau of Land Management (outer continental shelf)
  - Geological Survey (outer continental shelf)
- Department of Transportation—
  - Coast Guard
- Environmental Protection Agency
- National Aeronautics and Space Administration (remote sensing)
- Water Resources Council
- River Basin Commissions (as geographically appropriate)

Waterway Regulation and Stream Modification

- Department of Agriculture—
  - Soil Conservation Service

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[1] River Basin Commissions (Delaware, Great Lakes, Missouri, New England, Ohio, Pacific Northwest, Souris-Red-Rainy, Susquehanna, Upper Mississippi) and similar Federal-State agencies should be consulted on actions affecting the environment of their specific geographic jurisdictions.

[2] In all cases where a proposed action will have significant international environmental effects, the Department of State should be consulted, and should be sent a copy of any draft and final impact statement which covers such action.

TABLE 7B (continued)

- Department of Defense—
  - Army Corps of Engineers
- Department of the Interior—
  - Bureau of Reclamation
  - Bureau of Sport Fisheries and Wildlife
  - Bureau of Outdoor Recreation
  - Geological Survey
- Department of Transportation—
  - Coast Guard
- Environmental Protection Agency
- National Aeronautics and Space Administration (remote sensing)
- Water Resources Council
- River Basin Commissions (as geographically appropriate)

FISH AND WILDLIFE

- Department of Agriculture—
  - Forest Service
  - Soil Conservation Service
- Department of Commerce—
  - National Oceanic and Atmospheric Administration (marine species)
- Department of the Interior—
  - Bureau of Sport Fisheries and Wildlife
  - Bureau of Land Management
  - Bureau of Outdoor Recreation
- Environmental Protection Agency

SOLID WASTE

- Atomic Energy Commission (radioactive waste)
- Department of Defense—
  - Army Corps of Engineers
- Department of Health, Education, and Welfare
- Department of the Interior—
  - Bureau of Mines (mineral waste, mine acid waste, municipal solid waste, recycling)
  - Bureau of Land Management (public lands)
  - Bureau of Indian Affairs (Indian lands)
  - Geological Survey (geologic and hydrologic effects)
  - Office of Saline Water (demineralization)
- Department of Transportation—
  - Coast Guard (ship sanitation)
- Environmental Protection Agency
- River Basin Commissions (as geographically appropriate)
- Water Resources Council

NOISE

- Department of Commerce—
  - National Bureau of Standards
- Department of Health, Education, and Welfare
- Department of Housing and Urban Development (land use and building materials aspects)
- Department of Labor—
  - Occupational Safety and Health Administration
- Department of Transportation—
  - Assistant Secretary for Systems Development and Technology
  - Federal Aviation Administration, Office of Noise Abatement
- Environmental Protection Agency
- National Aeronautics and Space Administration

RADIATION

- Atomic Energy Commission
- Department of Commerce—
  - National Bureau of Standards
- Department of Health, Education, and Welfare
- Department of the Interior—
  - Bureau of Mines (uranium mines)
  - Mining Enforcement and Safety Administration (uranium mines)
- Environmental Protection Agency

HAZARDOUS SUBSTANCES

Toxic Materials

- Atomic Energy Commission (radioactive substances)
- Department of Agriculture—
  - Agricultural Research Service
  - Consumer and Marketing Service
- Department of Commerce—
  - National Oceanic and Atmospheric Administration
- Department of Defense
- Department of Health, Education, and Welfare
- Environmental Protection Agency

Food Additives and Contamination of Foodstuffs

- Department of Agriculture—
  - Consumer and Marketing Service (meat and poultry products)
- Department of Health, Education, and Welfare
- Environmental Protection Agency

Pesticides

- Department of Agriculture—
  - Agricultural Research Service (biological controls, food and fiber production)
  - Consumer and Marketing Service
  - Forest Service
- Department of Commerce—
  - National Oceanic and Atmospheric Administration
- Department of Health, Education, and Welfare
- Department of the Interior—
  - Bureau of Sport Fisheries and Wildlife (fish and wildlife effects)
  - Bureau of Land Management (public lands)
  - Bureau of Indian Affairs (Indian lands)
  - Bureau of Reclamation (irrigated lands)
- Environmental Protection Agency

Transportation and Handling of Hazardous Materials

- Atomic Energy Commission (radioactive substances)
- Department of Commerce—
  - Maritime Administration
  - National Oceanic and Atmospheric Administration (effects on marine life and the coastal zone)

TABLE 78. (continued)

- Department of Defense—
  - Armed Services Explosive Safety Board
  - Army Corps of Engineers (navigable waterways)
- Department of Transportation—
  - Federal Highway Administration, Bureau of Motor Carrier Safety
  - Coast Guard
  - Federal Railroad Administration
  - Federal Aviation Administration
  - Assistant Secretary for Systems Development and Technology
  - Office of Hazardous Materials
  - Office of Pipeline Safety
- Environmental Protection Agency

ENERGY SUPPLY AND NATURAL RESOURCES DEVELOPMENT

Electric Engergy Development, Generation, and Transmission, and Use

- Atomic Energy Commission (nuclear)
- Department of Agriculture—
  - Rural Electrification Administration (rural areas)
- Department of Defense—
  - Army Corps of Engineers (hydro)
- Department of Health, Education, and Welfare (radiation effects)
- Department of Housing and Urban Development (urban areas)
- Department of the Interior—
  - Bureau of Indian Affairs (Indian lands)
  - Bureau of Land Management (public lands)
  - Bureau of Reclamation
  - Power Marketing Administrations
  - Geological Survey
  - Bureau of Sport Fisheries and Wildlife
  - Bureau of Outdoor Recreation
  - National Park Service
- Environmental Protection Agency
- Federal Power Commission (hydro, transmission, and supply)
- River Basin Commissions (as geographically appropriate)
- Tennessee Valley Authority
- Water Resources Council

Petroleum Development, Extraction, Refining, Transport, and Use

- Department of the Interior—
  - Office of Oil and Gas
  - Bureau of Mines
  - Geological Survey
  - Bureau of Land Management (public lands and outer continental shelf)
  - Bureau of Indian Affairs (Indian lands)
  - Bureau of Sport Fisheries and Wildlife (effects on fish and wildlife)
  - Bureau of Outdoor Recreation
  - National Park Service
- Department of Transportation (Transport and Pipeline Safety)
- Environmental Proection Agency
- Interstate Commerce Commission

Natural Gas Development, Production, Transmission, and Use

- Department of Housing and Urban Development (urban areas)
- Department of the Interior—
  - Office of Oil and Gas
  - Geological Survey
  - Bureau of Mines
  - Bureau of Land Management (public lands)
  - Bureau of Indian Affairs (Indian lands)
  - Bureau of Sport Fisheries and Wildlife
  - Bureau of Outdoor Recreation
  - National Park Service
- Department of Transportation (transport and safety)
- Environmental Protection Agency
- Federal Power Commission (production, transmission, and supply)
- Interstate Commerce Commission

Coal and Minerals Development, Mining, Conversion, Processing, Transport, and Use

- Appalachian Regional Commission
- Department of Agriculture—
  - Forest Service
- Department of Commerce
- Department of the Interior—
  - Office of Coal Research
  - Mining Enforcement and Safety Administration
  - Bureau of Mines
  - Geological Survey
  - Bureau of Indian Affairs (Indian lands)
  - Bureau of Land Management (public lands)
  - Bureau of Sport Fisheries and Wildlife
  - Bureau of Outdoor Recreation
  - National Park Service
- Department of Labor—
  - Occupational Safety and Health Administration
- Department of Transportation
- Environmental Protection Agency
- Interstate Commerce Commission
- Tennessee Valley Authority

Renewable Resource Development, Production, Management, Harvest, Transport, and Use

- Department of Agriculture—
  - Forest Service
  - Soil Conservation Service
- Department of Commerce
- Department of Housing and Urban Development (building materials)
- Department of the Interior—
  - Geological Survey
  - Bureau of Land Management (public lands)
  - Bureau of Indian Affairs (Indian lands)
  - Bureau of Sport Fisheries and Wildlife
  - Bureau of Outdoor Recreation
  - National Park Service
- Department of Transportation
- Environmental Protection Agency
- Interestate Commerce Commission (freight rates)

Energy and Natural Resources Conservation

- Department of Agriculture—
  - Forest Service
  - Soil Conservation Service

TABLE 76. (continued)

- Department of Commerce—
  - National Bureau of Standards (energy efficiency)
- Department of Housing and Urban Development—
  - Federal Housing Administration (housing standards)
- Department of the Interior—
  - Office of Energy Conservation
  - Bureau of Mines
  - Bureau of Reclamation
  - Geological Survey
  - Power Marketing Administration
- Department of Transportation
- Environmental Protection Agency
- Federal Power Commission
- General Services Administration (design and operation of building)
- Tennessee Valley Authority

LAND USE AND MANAGEMENT

Land Use Changes, Planning and Regulation of Land Development

- Department of Agriculture—
  - Forest Service (forest lands)
  - Agricultural Research Servico (agricultural lands)
- Department of Housing and Urban Development
- Department of the Interior—
  - Office of Land Use and Water Planning
  - Bureau of Land Management (public lands)
  - Bureau of Indian Affairs (Indian lands)
  - Bureau of Sport Fisheries and Wildlife (wildlife refuges)
  - Bureau of Outdoor Recreation (recreation lands)
  - National Park Service (NPS units)
- Department of Transportation
- Environmental Protection Agency (pollution effects)
- National Aeronautics and Space Administration (remote sensing)
- River Basins Commissions (as geographically appropriate)

Public Land Management

- Department of Agriculture—
  - Forest Service (forests)
- Department of Defense
- Department of the Interior—
  - Bureau of Land Management
  - Bureau of Indian Affairs (Indian lands)
  - Bureau of Sport Fisheries and Wildlife (wildlife refuges)
  - Bureau of Outdoor Recreation (recreation lands)
  - National Park Service (NPS units)
- Federal Power Commission (project lands)
- General Services Administration
- National Aeronautics and Space Administration (remote sensing)
- Tennessee Valley Authority (project lands)

PROTECTION OF ENVIRONMENTALLY CRITICAL AREAS—FLOODPLAINS, WETLANDS, BEACHES AND DUNES, UNSTABLE SOILS, STEEP SLOPES, AQUIFER RECHARGE AREAS, ETC.

- Department of Agriculture—
  - Agricultural Stabilization and Conservation Service
  - Soil Conservation Service
  - Forest Service
- Department of Commerce—
  - National Oceanic and Atomspheric Administration (coastal areas)
- Department of Defense—
  - Army Corps of Engineers
- Department of Housing and Urban Development (urban and floodplain areas)
- Department of the Interior—
  - Office of Land Use and Water Planning
  - Bureau of Outdoor Recreation
  - Bureau of Reclamation
  - Bureau of Sport Fisheries and Wildlife
  - Bureau of Land Management
  - Geological Survey
- Environmental Protection Agency (pollution effects)
- National Aeronautics and Space Administration (remote sensing)
- River Basins Commissions (as geographically appropriate)
- Water Resources Council

LAND USE IN COASTAL AREAS

- Department of Agriculture—
  - Forest Service
  - Soil Conservation Service (soil stability, hydrology)
- Department of Commerce—
  - National Oceanic and Atmospheric Administration (impact on marine life and coastal zone management)
- Department of Defense—
  - Army Corps of Engineers (beaches, dredge and fill permits, Refuse Act permits)
- Department of Housing and Urban Development (urban areas)
- Department of the Interior—
  - Office of Land Use and Water Planning
  - Bureau of Sport Fisheries and Wildlife
  - National Park Service
  - Geological Survey
  - Bureau of Outdoor Recreation
  - Bureau of Land Management (public lands)
- Department of Transportation—
  - Coast Guard (bridges, navigation)
- Environmental Protection Agency (pollution effects)
- National Aeronautics and Space Administration (remote sensing)

REDEVELOPMENT AND CONSTRUCTION IN BUILT-UP AREAS

- Department of Commerce—
  - Economic Development Administration (designated areas)
- Department of Housing and Urban Development
- Department of the Interior—
  - Office of Land Use and Water Planning
- Department of Transportation

TABLE 78. (continued)

- Environmental Protection Agency
- General Services Administration
- Office of Economic Opportunity

DENSITY AND CONGESTION MITIGATION

- Department of Health, Education, and Welfare
- Department of Housing and Urban Development
- Department of the Interior—
  - Office of Land Use and Water Planning
  - Bureau of Outdoor Recreation
- Department of Transportation
- Environmental Protection Agency

NEIGHBORHOOD CHARACTER AND CONTINUITY

- Department of Health, Education, and Welfare
- Department of Housing and Urban Development
- National Endowment for the Arts
- Office of Economic Opportunity

IMPACTS ON LOW-INCOME POPULATIONS

- Department of Commerce—
  - Economic Development Administration (designated areas)
- Department of Health, Education, and Welfare
- Department of Housing and Urban Development
- Office of Economic Opportunity

HISTORIC, ARCHITECTURAL, AND ARCHEOLOGICAL PRESERVATION

- Advisory Council on Historic Preservation
- Department of Housing and Urban Development
- Department of the Interior—
  - National Park Service
  - Bureau of Land Management (public lands)
  - Bureau of Indian Affairs (Indian lands)
- General Services Administration
- National Endownment for the Arts

SOIL AND PLANT CONSERVATION AND HYDROLOGY

- Department of Agriculture—
  - Soil Conservation Service
  - Agricultural Service
  - Forest Service
- Department of Commerce—
  - National Oceanic and Atmospheric Administration
- Department of Defense—
  - Army Corps of Engineers (dredging, aquatic plants)
- Department of Health, Education, and Welfare
- Department of the Interior—
  - Bureau of Land Management
  - Bureau of Sport Fisheries and Wildlife
  - Geological Survey
  - Bureau of Reclamation
- Environmental Protection Agency
- National Aeronautics and Space Administration (remote sensing)
- River Basin Commissions (as geographically appropriate)
- Water Resources Council

OUTDOOR RECREATION

- Department of Agriculture—
  - Forest Service
  - Soil Conservation Service
- Department of Defense—
  - Army Corps of Engineers
- Department of Housing and Urban Development (urban areas)
- Department of the Interior—
  - Bureau of Land Management
  - National Park Service
  - Bureau of Outdoor Recreation
  - Bureau of Sport Fisheries and Wildlife
  - Bureau of Indian Affairs
- Environmental Protection Agency
- National Aeronautics and Space Administration (remote sensing)
- River Basin Commissions (as geographically appropriate)
- Water Resources Council

APPENDIX A

PUBLIC LAWS
AND
CODE OF FEDERAL REGULATIONS CITATIONS

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CLEAN AIR ACT

Public Law 88-206, 77 Stat. 392 (1965), 42 U.S.C. 7401 et seq; as amended by the Air Quality Act of 1967, P.L. 90-148, the Clean Air Amendments of 1970, P.L. 91-604, (1970), P.L. 92-157, 85 Stat. 431, P.L. 93-15, 87 Stat. 11, P.L. 93-319, 88 Stat. 246, the Clean Air Act Amendments of 1977, P.L. 95-95, 91 Stat 685, and P.L. 95-190, 91 Stat. 1393.

Parts of the Clean Air Act Regulations as listed in CFR Title 40, Chapter 1:

National Primary and Secondary Ambient Air Quality Standards	Part 50
Requirements for Preparation, Adoption, and Submittal of Implementation Plans	Part 51
Approval and Promulgation of Implementation Plans	Part 52
Prior Notice of Citizen Suits	Part 54
Energy Related Authority	Part 55
Standards of Performance for New Stationary Sources	Part 60
National Emission Standards for Hazardous Air Pollutants	Part 61
Prevention, Control, and Abatement of Air Pollution From Federal Government Activities: Performance Standards and Techniques of Measurement	Part 76
Registration of Fuel Additives	Part 79
Regulation of Fuels and Fuel Additives	Part 80
Air Quality Control Regions, Criteria, and Control Techniques	Part 81
Control of Air Pollution From New Motor Vehicles and New Motor Vehicle Engines	Part 85
Control of Air Pollution From New Motor Vehicles and New Motor Vehicle Engines: Certification and Test Procedures	Part 86
Control of Air Pollution From Aircraft and Aircraft Engines	Part 87
Procedures For Certification of Low-Emission Vehicles	Part 400
General Provisions	Part 401

FEDERAL WATER POLLUTION CONTROL ACT

Act of June 30, 1948, Ch. 758, as amended by P.L. 92-500; P.L. 93-207, December 28, 1973; P.L. 93-243, January 2, 1974; P.L. 93-611, January 2, 1975; P.L. 94-238, 90 Stat. 250, March 23, 1976, and by P.L. 95-217, 91 Stat. 1566, December 27, 1977.

Parts of the Federal Water Pollution Control Act as listed in CFR 40, Chapter 1:

Loan Guarantees for Construction of Treatment Works	Part 39
Research And Demonstration Grants	Part 40
Public Hearings on Effluent Standards for Toxic Pollutants	Part 104
Public Participation in Water Pollution Control	Part 105
Criteria for State, Local, and Regional Oil Removal Contingency Plans	Part 109
Discharge of Oil	Part 110
Oil Pollution Prevention	Part 112
Liability Limits for Small Onshore Storage Facilities	Part 113
Civil Penalties for Violation of Oil Pollution Prevention Regulations	Part 114
Aquaculture Projects	Part 115
Designation of Hazardous Substances	Part 116
Determination of Removability of Hazardous Substances	Part 117
Determination of Harmful Quantities for Hazardous Substances	Part 118
Determination of Units of Measurement and Rates of Penalty for Hazardous Substances	Part 119
Water Quality Standards	Part 120
Thermal Discharges	Part 122
State Certification of Activities Requiring A Federal License or Permit	Part 123
State Program Elements Necessary For Participation in the National Pollutant Discharge Elimination System	Part 124
National Pollutant Discharge Elimination System	Part 125

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SAFE DRINKING WATER ACT

Public Law 93-523, 86 Stat. 1660, as amended by P.L. 95-190, 91 Stat. 1393.

Parts of the Safe Drinking Water Act regulations as listed in CFR 40, Chapter 1:

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OCCUPATIONAL SAFETY AND HEALTH ACT

Public Law 91-596, 84 Stat. 1590, December 29, 1970.

Parts of the Occupational Safety and Health Act regulations as listed in CFR 29, Chapter XVII:

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Coal tar pitch volatiles: Interpretation of term	Part 1910.1002
4-Nitrophenyl	Part 1910.1003
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41 CFR 50-204, 50 except for Table Z2, the source of which is ANSI, Z37 series

CFR 41, Part 50-214--Safety and Health Standards for Federal Supply Contracts

- Subpart A - Scope and application
- Subpart B - General safety and health standards
- Subpart C - Radiation standards
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ATOMIC ENERGY ACT

Atomic Energy Act of 1954, Public Law 703, August 30, 1954.

Parts of the Atomic Energy Act Regulations as listed in CRF 10, Chapter 1:

Standards for Protection Against Radiation . . . . Part 20

Parts of the Atomic Energy Act Regulations as listed in CFR 40, Chapter 1:

Environmental Radiation Protection Standards for Nuclear Power Operations . . . . Part 190

TOXIC SUBSTANCES CONTROL ACT

Public Law 94-469, October 11, 1976.

Parts of the Toxic Substances Control Act Regulations as listed in CFR 40, Chapter 1:

Polychlorinated Biphenyls (PCBs)	Part 761
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FEDERAL ENVIRONMENTAL PESTICIDE CONTROL ACT
(Federal Insecticide, Fungicide, and Rodenticide Act)

Public Law 92-516, 86 Stat. 973, as amended by P.L. 94-51, 89 Stat. 257, July 2, 1975, P.L. 94-109, 89 Stat. 571, October 10, 1975, and P.L. 94-140, 89 Stat. 751, November 28, 1975.

Parts of the Federal Insecticide, Fungicide, and Rodenticide Act Regulations as listed in CFR 40, Chapter 1:

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Parts of the Federal Insecticide, Fungicide, and Rodenticide Act Regulations as listed in CFR 21, Chapter 1:

Tolerances for Pesticides in Food Administered by the Environmental Protection Agency	Part 193

NOISE CONTROL ACT

Public Law 92-574, 86 Stat. 1234, as amended by P.L. 94-301, 90 Stat. 590, May 31, 1976.

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RESOURCE CONSERVATION AND RECOVERY ACT

Public Law 94-580, 90 Stat. 2795, October 21, 1976.

Parts of the Resource Conservation and Recovery Act Regulations as listed in CFR 40, Chapter 1:

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Guidelines for the Storage and Collection of Residential, Commercial, and Institutional Solid Waste	Part 243
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Public Participation in Solid Waste Management	Part 249
Prior Notice of Citizen Suits	Part 254
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MARINE PROTECTION, RESEARCH, AND SANCTUARIES ACT

Public Law 92-532, 86 Stat. 1052, October 23, 1972, as amended by P.L. 93-254, by P.L. 93-472, 88 Stat. 1430, October 26, 1974; by P.L. 94-62, 89 Stat. 303, July 25, 1975; by P.L. 94-326, 90 Stat. 725, June 30, 1976 and by P.L. 95-153, 91 Stat. 1255, November 4, 1977.

Parts of the Marine Protection, Research, and Sanctuaries Act Regulations as listed in CFR 40, Chapter 1:

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Applications . . . . Part 221

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NATIONAL ENVIRONMENTAL POLICY ACT

Public Law 91-190, 83 Stat. 852 (1970); as amended by P.L. 94-83, 89 Stat. 424 (1975).

Parts of the National Environmental Policy Act Regulations as listed in CFR 40, Chapter 5:

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OIL POLLUTION ACT

Public Law 87-167, August 30, 1961, 75 Stat. 402, 33 U.S.C. 1001-1015; as last amended by P.L. 93-119, 80 Stat. 372 (1973).

Parts of the Oil Pollution Act Regulations as listed in CFR 33, Chapter 1:

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COASTAL ZONE MANAGEMENT ACT

Public Law, 92-583, 86 Stat. 1280, 10/27/72, as amended by Public Law 93-612, 1/2/75 and Public Law 94-370, 7/26/76.

Parts of the Coastal Zone Management Act Regulations as listed in CFR 15, Chapter 9:

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APPENDIX B

BIBLIOGRAPHY

BIBLIOGRAPHY

The following is a selected bibliography, which includes a listing of many additional sources for background information on the subject of environmental regulation.

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APPENDIX C

CRITERIA DOCUMENTS

APPENDIX C

Appendix C is a listing of Criteria Documents with their publication numbers that have been issued by NIOSH and ANSI. They may be obtained by ordering from the address given at the beginning of each list.

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U.S. Department of Health, Education and Welfare
Public Health Service
Center for Disease Control
National Institute for Occupational Safety and Health
Cincinnati, Ohio

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FEB 1978

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RECOMMENDED HEALTH AND SAFETY GUIDELINES FOR COAL GASIFICATION PILOT PLANTS	78-120

American National Standards Institute
1430 Broadway
New York, New York 10018

Z37.1-1941	(R 1971) Carbon Monoxide
Z37.2-1972	Hydrogen Sulfide
Z37.3-1968	(R 1973) Carbon Disulfide
Z37.4-1969	Benzene
Z37.5-1970	Cadmium Fume and Cadmium Dusts
Z37.6-1948	(R 1971) Manganese
Z37.7-1973	Chromic Acid and Chromates
Z37.8-1972	Inorganic Mercury and Non-alkyl Organo Compounds
Z37.10-1971	Xylene
Z37.11-1969	Lead and Its Inorganic Compounds
Z37.12-1974	Toluene
Z37.13-1971	Nitrogen Dioxide
Z37.14-1971	Methanol
Z37.15-1969	Styrene
Z37.16-1967	(R 1973) Formaldehyde
Z37.17-1967	(R 1973) Carbon Tetrachloride
Z37.18-1969	Methyl Chloride
Z37.19-1967	Trichloroethylene
Z37.21-1969	Ethylene Dichloride
Z37.22-1967	Tetrachloroethylene
Z37.23-1969	Methylene Chloride (Dichloromethane)
Z37.24-1970	Methyl Bromide (Monobromomethane)
Z37.25-1974	Chlorine
Z37.26-1970	Methyl Chloroform (1,1,1-Trichloroethane)
Z37.27-1970	Paradichlorobenzene (1,4-Dichlorobenzene)
Z37.28-1969	(R 1973) Hydrogen Fluoride & Inorganic Fluoride Dusts
Z37.29-1970	Beryllium and Beryllium Compounds
Z37.31-1970	Ethylene Dibromide
Z37.32-1971	Acetone

Z37.35-1973	Trifluoroethane (Fluorocarbon 113)
Z37.36-1973	Trichlorofluoromethane (Fluorocarbon 11)
Z37.38-1974	Dichlorodifluoromethane (Fluorocarbon 12)
Z37.39-1974	Acetic Acid
Z129.1-1976	Precautionary Labeling of Hazardous Industrial Chemicals
Z136.1-1976	Lasers, Safe Use of
Z245.1-1975	Refuse Collection and Compaction Equipment, Safety Requirements for

APPENDIX D

UNITS OF QUANTITATIVE LEVELS FOR POLLUTANT REGULATION

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APPENDIX D

UNITS OF QUANTITATIVE LEVELS FOR POLLUTANT REGULATION

Some of the terms used in defining regulated pollution control are less common than others. A brief refresher:

$\underline{BOD_5}$, biological oxygen demand, 5-day test period. Usually defined as the amount of oxygen required by bacteria while stabilizing decomposible matter under aerobic conditions.

$$BOD_5\left(\frac{\text{mg } O_2}{\text{l water}}\right) = (DO_s)_o - (DO_s)_{5\text{ days}},$$

for nondiluted samples.

$$BOD_5 = \left[(DO_b - DO_i)\,\frac{100}{\%}\right] - \left[DO_b - (DO_s)_o\right],$$

diluted samples (with water),

where DO_s = dissolved oxygen in nondiluted samples.
DO_b = dissolved oxygen in control blank of dilution water at end of 5 days.
DO_i = dissolved oxygen in diluted sample at the end of 5 days.
% = percent of sample in diluted mixture.

curie. Measure of radioactivity. The quantity of radioactive material exhibiting 3.70×10^{10} disintegrations/second.

dBA, decibel. Expresses relative loudness of sound. Zero dBA is barely audible. Hearing impairment is medically defined as the inability to hear below 25 dBA, at 500, 1000, and 2000 Hz.

50 dBA = average conversation; 60 dBA = average factory.
80 dBA = noisy office; 100 dBA = loud street noise.
110 dBA = nearby riveter (deafening); 120 dBA = thunder, artillery (pain threshold).

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$$\text{Sound Pressure Level} = 20 \log_{10} \frac{P}{P_o} \text{ dBA}$$

P = sound pressure - dyne/cm^2

P_o = 0.002 dyne/cm^2.

hectare. 10,000 m^2 area.

joule. 1 newton-meter, or 1 kg-meter/sec^2.

LC_{50}. The calculated concentration of a substance in either air or water (as separate figures) which will cause the death of 50 percent of an experimental animal population under controlled conditions and time exposure, usually 96 hours for aquatic species.

LD_{50}. The lethal dose to 50 percent of a population (of test animals); the calculated dose of a chemical substance which is expected to cause the death of half the population through exposure to the substance by any route other than inhalation (e.g., ingestion, injection).

no discharge (zero discharge). Usually implies that no process effluent will increase a pollutant level above existing background, ambient levels, i.e., no net pollutant increase in the environment.

opacity. The measurement of light extinction by particles in the air, caused by scattering and absorption. The reduction in intensity, I, of a light beam of intensity I_o, over a distance, x, is given by

$$I = I_o \exp(-\sigma x)$$

where σ is the extinction coefficient.

$$\% \text{ opacity} = 100 \left(1 - \frac{I}{I_o}\right) = 100 \left(1 - e^{-\sigma x}\right).$$

Various levels of % opacity correspond to shades (gray-to-black, 0-5) on the widely used Ringelmann chart.

pH. Universal term for expressing the intensity of the acid or alkaline condition of a solution. It thus defines the hydrogen ion concentration, or more closely, the hydrogen ion activity.

$$\text{pH} = -\log_{10}[H^+].$$

ppm, ppb. Parts per million and parts per billion respectively. May be expressed as volume or mass concentrations, e.g.,

$$1\ \text{ppm}_{\text{volume}} = 1\ \text{milliliter/m}^3$$

$$= 1\ \text{mole pollutant}/10^6\ \text{moles air}$$

$$\text{or,}\quad 1\ \text{ppb}_{\text{mass}} = 1\ \text{microgram/1 kilogram.}$$

rem. Roentgen equivalent man. Measure of radiation hazard from radioactive sources. The rem takes into account that heavy particles (e.g., protons, neutrons, alpha particles) cause greater biological effects than electrons, gamma rays or X-rays.

1 rem = 1 rad x RBE (relative biological effect)

= (ergs of radiant energy absorbed/gram of tissue) x RBE.

threshold odor number. This number is obtained by adding a sample to 200 ml of distilled water until an odor is barely detectable from the water. The sample threshold value (in ml) divided into 200 ml is then the odor number; e.g., if odor is first detected after adding 12.5 ml of sample,

$$\text{Threshold Odor No.} = \frac{200}{12.5} = 16.$$

TSS, total suspended solids (nondissolved suspended matter) in water. Measured by filtering through a Gooch crucible and weighing, or by filtering water through a paper filter and calculating the difference between total solids in unfiltered and filtered samples.

TWA, time weighted average. Usually refers to an "average" pollutant concentration over a specified time period, which may commonly vary from 8 hours to one year. TWA limits permit excursions above the limit provided they are compensated by equivalent excursions below the limit during the time period.

watt. 1 joule/second.

Prefixes in the International System of Units (SI) used in expressing quantitative regulations:

Giga - (G) 10^9
Mega - (M) 10^6
Kilo - (k) 10^3
Hecto - (h) 10^2
Deka - (da) 10^1
Deci - (d) 10^{-1}

Centi - (c) 10^{-2}
Milli - (m) 10^{-3}
Micro - (μ) 10^{-6}
Nano - (n) 10^{-9}
Pico - (p) 10^{-12}

Some difficulties arise in attempting to compare regulatory controls (e.g., on the basis of which one demands most stringent control) because different regulations for the same pollutant are often expressed in different units. Part of the problem arises from the fact that regulations must often be tailored to the source type, such as vehicles, industry, and disposal or treatment systems. The units or descriptive terms of regulations may also be associated with sampling or measurement approaches.

On the other hand, regulations must be related to control levels for pollutants in the environment, based on toxicological, medical, epidemiological, and ecological studies. This relationship has been most widely interpreted in terms of concentrations of pollutants in the various media--air, water, soil. Many regulations are already expressed in $\mu g/m^3$, mg/l, mg/kg, and similar units. For some of those which are not expressed in this manner, some possible unit conversion approaches for comparison purposes are discussed below.

One approach for comparing regulations is to narrow the scope of comparison to source emission constraints. This restriction eliminates the problem of attempting to estimate ambient pollutant concentration from source emissions data, utilizing dispersion models. Therefore, the conversions described in Table D-1 are some possible, though not necessarily recommended, approaches for normalizing regulation limits to concentrations of pollutants at the pollution source.

The expression of pollutant concentrations as mass per unit volume (in fluids) or per unit mass (in land) is the most universal approach and can be applied to almost any regulation involving control of particular substances. Much interpretation of environmental data in terms of Multimedia Environmental Goals, Source Analysis Models, Threshold Limit Values, and other methodologies utilized by environmental agencies is expressed in these concentration units.

TABLE D-1. UNIT CONVERSIONS

Current Regulation Units	Typical Conversion (to source concentration)	Conversion Coefficients
Pollutant Concentrations		
ppm_{volume}	for air pollution:* $1\ ppm = 24.45\ \frac{1}{MW_p}\ \frac{mg}{m^3}$	MW_p = molecular weight of pollutant
	for water pollution: $1\ ppm = \rho\ \frac{mg}{\ell}$	ρ = pollutant density $\left(\frac{g}{m\ell}\right)$
ppm_{mass}	for air pollution:* $1\ ppm = 1.185\ \frac{mg}{m^3}$	
	for water pollution: $1\ ppm = 1\ \frac{mg}{\ell}$	
	for solid waste or raw solid product (such as pesticides on crops): $1\ ppm = 1\ \frac{mg}{kg}$	
% volume	-- same as ppm x 10^4 --	
	% volume = $409 \times MW_p\ \frac{mg}{m^3}$	
% mass	-- same as ppm x 10^4 --	

*For air at 25°C; 760 mm Hg; 24.45 ℓ/g-mole; 28.97 g/g-mole.

TABLE D-1. UNIT CONVERSIONS (continued)

Current Regulation Units	Typical Conversions (to source concentration)	Conversion Coefficients
Pollutant Mass Levels per Feedstock or Product		
Examples:		
lb pollutant/ton product, mg/kg input	$\text{mg/kg} = \frac{1}{R}\ \frac{\text{mg pollutant}}{\text{m}^3\ \text{stream}}$	$R = \frac{\ell\ \text{polluted stream}}{\text{g (feed, product)}}$
Land Area Pollution		
kg/ha	$1\ \frac{\text{kg}}{\text{ha}} = \frac{1}{10\,\rho\, d}\ \frac{\text{mg}}{\text{kg soil}}$	ρ = soil density (g/cm^3) d = soil depth (cm)
Pollutant Level per Unit Time		
Example:		
g/hr	$1\ \text{g/hr} = \frac{10^5}{6Q}\ \frac{\text{mg}}{\text{m}^3}$ or $1\ \text{g/hr} = \frac{1}{Q}\ \frac{\text{g}}{\text{kg}}$	Q = volumetric or solid mass flow rate of polluted stream: $\frac{\ell}{\text{min}}, \frac{\text{kg}}{\text{hr}}$

TABLE D-1. UNIT CONVERSIONS (continued)

Current Regulation Units	Typical Conversions (to source concentration)	Conversion Coefficients
Pollutant Level per Energy Input/Output		
Examples:		
mg/joule heat fuel input	$\frac{\text{mg}}{\text{Joule}} = \frac{R}{H}\ \frac{\text{mg}}{\text{m}^3}$	R = volume of output/feed mass$\left(\frac{\text{m}^3}{\text{kg}}\right)$ H = fuel heating value$\left(\frac{\text{joule}}{\text{kg}}\right)$
lb/1000 hp-hour	$= \frac{\text{H.P.}}{7.6Q}\ \frac{\text{mg}}{\text{m}^3}$	Q = exhaust flow rate (m^3/min) H.P. = horsepower
lb/100 lb-thrust-hour cycle	$= \frac{F}{75.8Q}\ \frac{\text{mg}}{\text{m}^3}$	Q = exhaust flow rate (m^3/min) F = engine lb-thrust cycle
mg/vehicle mile	$= \frac{\text{mpg}}{R}\ \frac{\text{mg}}{\text{m}^3}$	R = $\frac{\text{exhaust volume}}{\text{volume fuel input}}\left(\frac{\text{m}^3}{\text{gal}}\right)$ mpg = miles/gallon
Radiation Limits		
pCi/ℓ	$1\ \text{pCi}/\ell = \frac{1}{37D}\ \frac{\text{mg}}{\ell}$	D = $\frac{\text{disintegrations}}{\text{second-gram substance}}$

TABLE D-1. UNIT CONVERSIONS (continued)

Current Regulation Units	Typical Conversions (to source concentration)	Conversion Coefficients
Radiation Limits (continued)		
millirem/year	$= (1333\ \pi\, d\, S_o d_o{}^2 \bar{t})^{-1}\ \frac{mg}{m^3}$ (for a single source) (this is a grossly simplified approach)	$S_o = \frac{\text{millirem}}{\text{gram-hr}}$ for a particular source at a given distance, d_o(m) $\bar{t}$ = exposure to source (hours/year) at a distance, d, from the source $S = \frac{S_o d_o{}^2}{d^2}\ \frac{\text{millirem}}{\text{g-hr}}$
Particulate Levels in Air		
% opacity	C = (concentration of particles of radius r) $= -\frac{4\rho_p r}{3000\ Dk} \ln\left(\frac{I}{I_o}\right) \frac{mg}{m^3}$ where $\left(\frac{I}{I_o}\right) = 1 - \frac{\%\ \text{opacity}}{100}$ $\%\ \text{opacity} = 100\left(1 - \exp\left[\frac{750\ DkC}{\rho_p\ r}\right]\right)$	D = plume diameter (m) ρ_p = particle density$\left(\frac{g}{cm^3}\right)$ k = scattering area ratio for particles of radius r (r in microns) I = light intensity

TABLE D-1. UNIT CONVERSIONS (continued)

Current Regulation Units	Typical Conversions (to source concentration)	Conversion Coefficients
Water Pollution Terms		
BOD_5	Considering biological oxidation as a first order reaction: $BOD_5 = xC_i(1-e^{-kt})\ \frac{mg}{\ell}$	$x = \frac{\text{mg oxygen reacted}}{\text{mg decomposible organics reacted}}$ C_i = concentration of decomposible organics of interest in sample, $\frac{mg}{\ell}$ k = reaction rate constant for disposable organics of interest, e.g., k_{avg} = 0.17/day, for domestic waste k normally ranges from 0.08 to 0.25/day for raw wastes and sewage t = 5 days
TSS	$TSS = \frac{\text{mg solids filtered}}{\ell \text{ water through filter}}$	

TABLE D-1. UNIT CONVERSIONS (continued)

Current Regulation Units	Typical Conversions (to source concentration)	Conversion Coefficients
Water Pollution Terms (continued)		
pH	There are $10^{4-pH} \frac{mg}{\ell}$ H^+ ions in a water solution at 25°C. $\frac{mg}{\ell}$ total acidity or alkalinity is commonly measured by titration, and determination of a particular acid concentration may be quite complex. For a simple case, however: Single strong acid, $\frac{mg}{\ell}\text{acid} = \frac{10^{-2\rho H}}{k_1}$	k_1 = ionization constant
counts/mℓ (fecal coliform)	$\frac{\text{counts}}{m\ell} = m_B \frac{mg}{\ell}$	m_B = bacterium mass (μg)
threshold odor number	$(\text{threshold odor number})^{-1}$ $= \frac{\rho}{5000} \frac{\text{mg sample}}{\ell \text{ water}}$	ρ = sample density $\left(\frac{g}{m\ell}\right)$
Toxicity Levels		
Example:		
% of 96-hr. LD_{50} or LC_{50} (for aquatic life)	$LD_{50} = \frac{wt}{V} \frac{mg}{\ell}$ $LC_{50} = \frac{mg}{\ell}$	V = milliters of water intake wt= mass of animal (g) or plant
Asbestos		
fibers/m^3	$\frac{\text{fibers}}{m^3} = 1000\, m_f \frac{mg}{m^3}$	m_f = μg/fiber

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